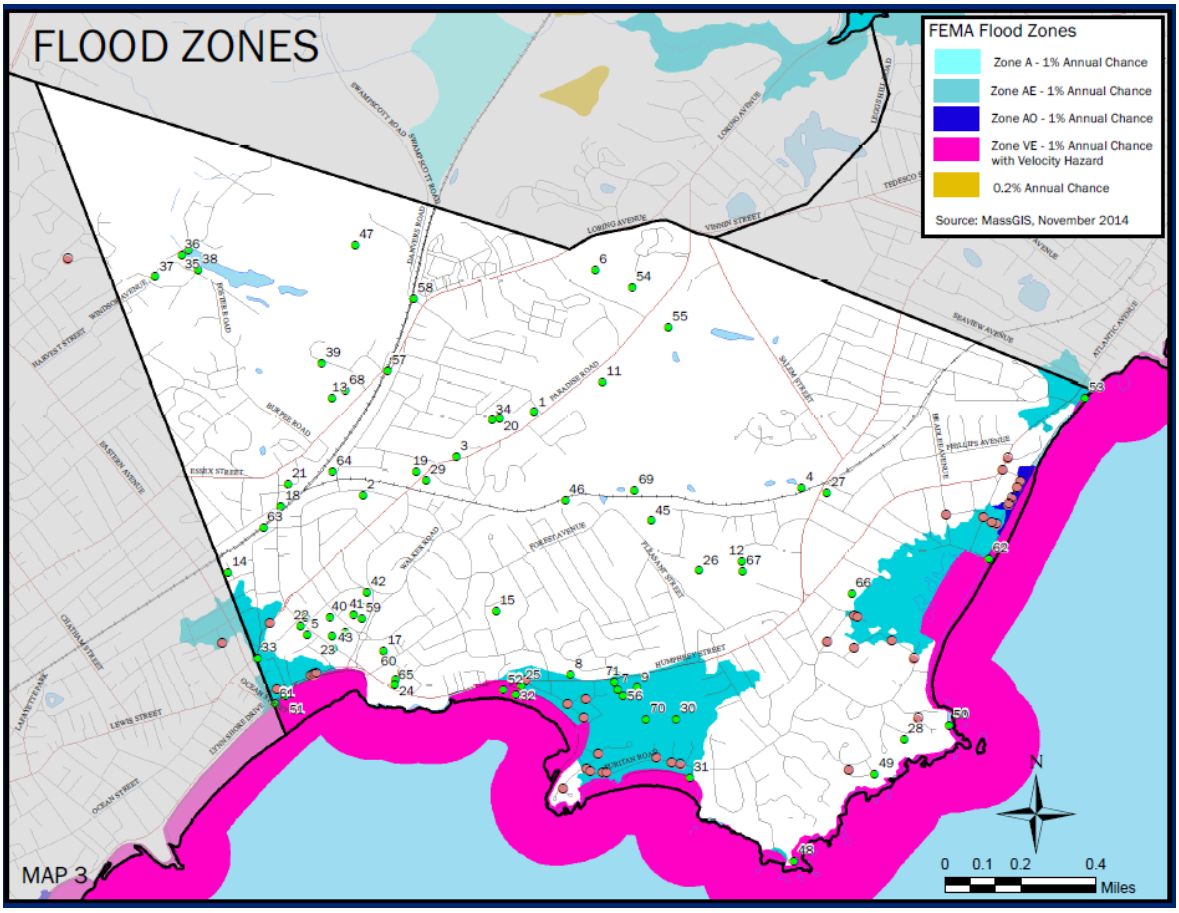
TOWN OF SWAMPSCOTT

HAZARD MITIGATION PLAN
2015 UPDATE



MAPC
METROPOLITAN AREA PLANNING COUNCIL

Metropolitan Area Planning Council

Final Plan
FEMA Approved Pending Adoption
October 8, 2015

[This page intentionally left blank]

TOWN OF SWAMPSCOTT HAZARD MITIGATION PLAN 2015UPDATE

ACKNOWLEDGEMENTS AND CREDITS

This plan was prepared for the Town of Swampscott by the Metropolitan Area Planning Council (MAPC) under the direction of the Massachusetts Emergency Management Agency (MEMA) and the Massachusetts Department of Conservation and Recreation (DCR). The plan was funded by the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM) Grant Program.

MAPC Officers

President:	Keith Bergman
Vice President:	Erin Wortman
Secretary:	Sandra Hackman
Treasurer:	Taber Keally
Executive Director:	Marc. D. Draisen

Credit

Project Manager:	Martin Pillsbury
Lead Project Planner:	Sam Cleaves
Mapping/GIS Services:	Susan Brunton

Massachusetts Emergency Management Agency

Director:	Kurt Schwartz

Department of Conservation and Recreation

Commissioner:	Leo Roy

Town of Swampscott, Emergency Management

Kevin Breen, Fire Chief

Local Hazard Mitigation Planning Team

Kevin Breen	Chief-Fire Department
James Potts	Fire Department
Gino Cresta	Director- Department of Public Works
S. Peter Kane	Director of Community Development

[This page intentionally left blank]

TOWN OF SWAMPSCOTT HAZARD MITIGATION PLAN 2015UPDATE

TABLE OF CONTENTS

LIST OF TABLES AND MAPS

TOWN OF SWAMPSCOTT HAZARD MITIGATION PLAN 2015UPDATE

I. EXECUTIVE SUMMARY

Hazard Mitigation planning is a proactive effort to identify actions that can be taken to reduce the dangers to life and property from natural hazard events. In the communities of the Boston region of Massachusetts, hazard mitigation planning tends to focus primarily on flooding, the most likely natural hazard to impact these communities. The Federal Disaster Mitigation Act of 2000 requires all municipalities that wish to be eligible to receive FEMA funding for hazard mitigation grants, to adopt a local multi-hazard mitigation plan and update this plan in five year intervals.

Planning Process

Planning for the update of the 2005 Swampscott Hazard Mitigation Plan update was led by the Swampscott Local Hazard Mitigation Planning Committee, composed of staff from a number of different Town Departments. This committee discussed where the impacts of natural hazards most affect the Town, goals for addressing these impacts, and hazard mitigation measures that would benefit the Town.

Public participation in this planning process is important for improving awareness of the potential impacts of natural hazards and to build support for the actions the Town takes to mitigate them. Two advertised public meetings were held, the first on February 6, 2012 with the Swampscott Planning Board and the second on March 14, 2012 with the Board of Selectmen. The draft Plan also was posted on the Town's website for public review and comment for a ten-day period following the two public meetings and completion of the first draft of the Plan. The Board of Selectmen meeting was televised live and re- broadcast. Both meetings included a description of the hazard mitigation planning process, an overview of the plan and proposed mitigation actions, as well as directions on how the public could access the draft plan on the Town website and make comments.
The public was given time to ask questions and comment at all public meetings.

Preceding these meetings, a public, regional meeting of the North Shore Multiple Hazard Community Planning Team was held February 8, 2010 to re-introduce participating communities to the hazard mitigation planning process and to identify inter-community hazard mitigation issues. A follow-up inter-regional public meeting and Natural Hazard Mitigation workshop was held on September 14, 2011 in Danvers, sponsored by MEMA MAPC and MA Coastal Zone Management.

Risk Assessment

The Plan update provides risk assessment for the following natural hazards in Swampscott: flooding, coastal hazards, wind, including hurricanes and nor'easters, brush fires, tornados, landslides and earthquakes, drought, extreme temperatures, and tsunami

Hazard Mitigation Goals

1. Ensure that critical infrastructure sites are protected from natural hazards.

2. Protect existing residential and business areas from flooding.

3. Prevent and reduce the damage to public infrastructure resulting from all natural hazards.
4. Continue to enforce existing zoning and building regulations.
5. Educate the public about zoning, flooding and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.
6. Encourage future development in areas that are not prone to natural hazards.
7. Educate the public about natural hazards and mitigation measures.
8. Make efficient use of public funds for hazard mitigation.
9. Protect the Town's ability to respond to various natural hazard events.

Highlighted Potential Hazard Mitigation Actions

- Upgrade Ocean Avenue outfall to prevent coastal surge and backflow.
- Identify where utility lines, drainage outfalls and houses can be elevated above flooding areas along Puritan Road between Lincoln House Point and Smith Lane.
- Purchase front-end loader with grapple for emergency tree and debris clearance.
- Complete Preston Beach outfall upgrade
- Complete and adopt new stormwater regulations.

Plan Review and Update Process

Table 1 Plan Review and Update

Chapter	Reviews and Updates
III – Public Participation	The Swampscott Local Committee placed an emphasis on public participation for the update of the Hazard Mitigation Plan, discussing strategies to enhance participation opportunities at the first local committee meeting. During plan development, the plan was presented to the Planning Board and the Board of Selectmen in public meetings. The Board of Selectmen's meeting was televised and re-broadcast. The plan was also available on the Town's website for public comment.
IV – Risk Assessment	MAPC gathered the most recently available hazard and land use data and met with Town staff to identify changes in local hazard areas and development trends. Town staff reviewed critical infrastructure with MAPC staff in order to create an up-to-date list. MAPC also used the most recently available version of HAZUS and assessed the potential impacts of flooding using the latest data.
V - Goals	The Hazard Mitigation Goals were reviewed and endorsed by the Local Hazard Mitigation Committee.
VI – Existing Mitigation Measures	The list of existing mitigation measures was updated to reflect current mitigation activities in the Town.
VII & VIII – Hazard Mitigation Strategy	Mitigation measures from the 2005 plan were reviewed and assessed as to whether they were completed, on-going, or deferred. The Local Committee determined whether to carry forward measures into the 2015 plan or delete them. The 2015 Hazard Mitigation Strategy reflects both new measures and measures carried forward from the 2005 plan. The Committee re-prioritized all of these measures based on current conditions
IX – Plan Adoption & Maintenance	This section of the plan was updated with a new on-going plan implementation review and five year update process that will assist the Town in incorporating hazard mitigation issues into other Town planning and regulatory review processes and better prepare the Town to update the plan in 2020.

Review of the 2005 Hazard Mitigation Plan

Swampscott made considerable progress on implementing mitigation measures identified in the 2005 Hazard Mitigation Plan. Although some projects were not able to be acted on due to budget constraints, many of the measures identified in that plan are now considered on-going aspects of the regular work of Town staff from the department head level to the regular work of Public Services staff. Moving forward into the next five-year plan implementation period there will be many more opportunities to incorporate hazard mitigation into the Town's decision making processes. Though not formally done in

the 2005 Plan, Swampscott will document any actions taken within this iteration of the Natural Hazard Mitigation on challenges met and actions successfully adopted as part of the ongoing work of the biannual survey and four year update to be conducted by the Hazard Mitigation Implementation Team, as described in Section IX, Plan Adoption and Maintenance. The Hazard Implementation Team did not meet regularly, conduct a bi-annual survey or four- year update as described in Section IX due to the absence of any one Town department having being designated to follow up and implement the Hazard Mitigation Plan, now designated to the Emergency Management Director to lead.

II. INTRODUCTION

Planning Requirements under the Federal Disaster Mitigation Act

The Federal Disaster Mitigation Act, passed in 2000, requires that after November 1 2004, all municipalities that wish to continue to be eligible to receive FEMA funding for hazard mitigation grants, must adopt a local multi-hazard mitigation plan and update this plan in five year intervals. This planning requirement does not affect disaster assistance funding.

Massachusetts has taken a regional approach and has encouraged the regional planning agencies to apply for grants to prepare plans for groups of their member communities. The Metropolitan Area Planning Council (MAPC) received a grant from the Federal Emergency Management Agency (FEMA) under the Pre-Disaster Mitigation (PDM) Program, to assist the Town of Swampscott and eight other North Shore communities to update their local Hazard Mitigation Plans, which were first adopted in as part of a North Shore Multi-Jurisdictional Hazard Mitigation Plan. The local Hazard Mitigation Plan updates produced under this grant are designed to individually meet the requirements of the Disaster Mitigation Act for each community.

In order to address multijurisdictional and regional issues, the participating municipalities were afforded the opportunity to meet with their neighboring communities during plan development. A public, regional meeting of the North Shore Multiple Hazard Community Planning Team was held February 8, 2010 to re-introduce participating communities to the hazard mitigation planning process and to identify inter-community hazard mitigation issues. MAPC has also produced a regional document that summarizes the issues and recommendations for the North Shore communities.

In addition, Swampscott was able to participate in a North Shore Natural Hazard Mitigation Plan Workshop held on September 14, 2011, sponsored jointly by MEMA, MA Coastal Zone Management and MAPC staff. The workshop was designed to help assist communities draft successful PDM plans, as well as providing a forum for sharing individual community plans on a regional basis; exploring inter-community questions, challenges and how to address them

What is a Hazard Mitigation Plan?

Natural hazard mitigation planning is the process of determining how to systematically reduce or eliminate the loss of life and property damage resulting from natural hazards such as floods, earthquakes, and hurricanes. Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries, and property resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, programs, projects, and other activities.

Previous Federal/State Disasters

The Town of Swampscott has experienced 17 natural hazards that triggered federal or state disaster declarations since 1991. These are listed in Table 2 below. The vast majority of these events involved flooding.

Table 2. Previous Federal/State Disaster Declarations

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
Hurricane Bob (August 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
Hurricane Bob (August 1991)	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (16 projects)
No-Name Storm (October 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
No-Name Storm (October 1991)	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
No-Name Storm (October 1991)	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (10 projects)
December Blizzard (December 1992)	FEMA Public Assistance Project Grants	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk
December Blizzard (December 1992	Hazard Mitigation Grant Program	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk (7 projects)
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	All 14 Counties
May Windstorm (May 1996)	State Public Assistance Project Grants	Counties of Essex, Plymouth, Norfolk, Bristol (27 communities)
October 1996 Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
October 1996 Flood (October 1996)-cont	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (36 projects)
October 1996 Flood (1997 grant issued)	Community Development Block Grant-HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
June Flood (June 1998)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (19 projects)
	Community Development Block Grant-HUD	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
March Flood (March 2001)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (16 projects)
February Snowstorm (Feb 17-18, 2003)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
May Rainstorm/Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	All 14 Counties
April Nor'easter (April 15-27, 2007)	FEMA Public Assistance Project Grants	Barnstable, Berkshire, Dukes, Essex, Franklin, Hampden, Hampshire, Plymouth

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
April Nor'easter (April 15-27, 2007)	Hazard Mitigation Grant Program	Statewide
Flooding (March, 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Statewide
Hurricane Earl (September, 2010)	FEMA Public Assistance Project Grants	Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, Worcester
Hurricane Irene (August, 2011)	FEMA Public Assistance Project Grants	All 14 Counties
Severe Storm (November 1, 2011)	FEMA Public Assistance Project Grants	Berkshire, Essex, Franklin, Hampden, Hampshire, Middlesex, Norfolk, Worcester
Hurricane Sandy October 27-30, 2012	FEMA Public Assistance	Statewide
Severe snowstorm and Flooding (February 8-09, 2013)	FEMA Public Assistance; Hazard Mitigation Grant Program	Statewide
Blizzard of 2015 January 26-28, 2015	FEMA Public Assistance; Hazard Mitigation Grant Program	Statewide

(Source: database provided by MEMA)

FEMA Funded Mitigation Projects

Over the last 20 years the Town of Swampscott has not received any funding from FEMA for project under the Hazard Mitigation Grant Program.

Community Profile

Swampscott is a town in Essex County, Massachusetts, located 15 miles up the coast from Boston in an area known as the North Shore. The population was 13,787 as of 2010.

According to the United States Census Bureau, the town has a total area of 6.7 square miles (17.4 km²), of which, 3.0 square miles (7.9 km²) of it is land and 3.7 square miles

(9.6 km²) of it (54.83%) is water. Located beside Massachusetts Bay and the Atlantic Ocean, Swampscott lies along a mostly rocky shoreline, though there is enough clear shore for five beaches; Phillips' which stretches into Preston and is by far the largest beach in town, New Ocean House and Whales, Fisherman's, and a part of King's Beach, which extends into Lynn. There are several small parks, along with the small Harold King Forest in the northwest corner of town and the Tedesco Country Club which bisects part of the town. The town also has two small ponds, Foster Pond and Palmer Pond.

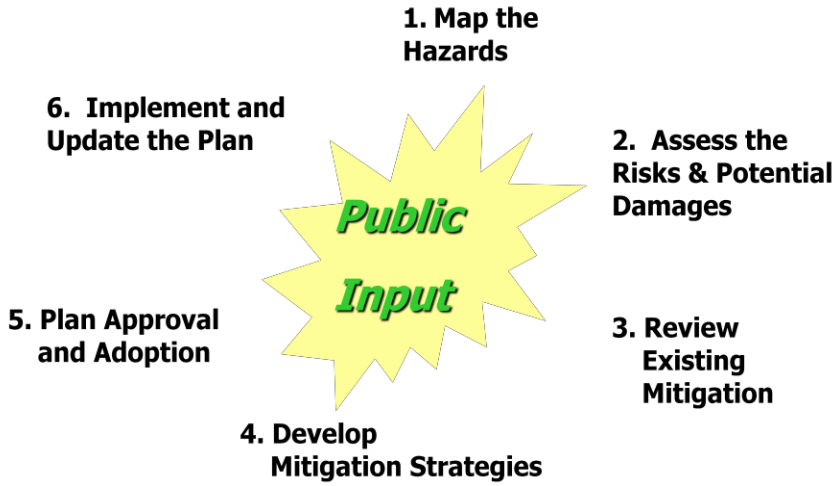
Swampscott is suburban in nature. Most of the clear land is in the swampy northwest corner of town. There are three villages within town, Beach Bluff to the east, Phillips Point to the south, and Phillips' Beach inland between the two. The town is centered on Monument Square, designed by Frederick Law Olmsted; which is four miles south of Salem, twelve miles northeast of Boston, and twenty miles southwest of Cape Ann

A former summer resort on Massachusetts Bay, Swampscott is today an affluent residential community, the 16th wealthiest in the state. It is known for its quiet suburban character and beaches. (*Wikipedia*)

[This page intentionally left blank]

III. PUBLIC PARTICIPATION

MAPC employs a six step planning process based on FEMA's hazard mitigation planning program focusing on local needs and priorities but maintaining a regional perspective matched to the scale and nature of natural hazard events. Public participation is a central component of this process, providing critical information about the local occurrence of hazards while also serving as a means to build a base of support for hazard mitigation activities. This process is illustrated and described below.



1. Map the Hazards – MAPC relies on data from a number of different federal, state, and local sources in order to map the areas with the potential to experience natural hazards. This mapping represents a multi-hazard assessment of the municipality and is used as a set of base maps for the remainder of the planning process. A particularly important source of information is the knowledge drawn from local municipal staff on where natural hazard impacts have occurred, which is collected. These maps can be found in Appendix B.

2. Assess the Risks & Potential Damages – Working with local staff, critical facilities, infrastructure, vulnerable populations, and other features are mapped and contrasted with the hazard data from the first step to identify those that might represent particular vulnerabilities to these hazards. Land use data and development trends are also incorporated into this analysis. In addition, MAPC develops estimates of the potential impacts of certain hazard events on the community.

3. Review Existing Mitigation – Municipalities in the Boston Metropolitan Region have an active history in hazard mitigation as many have adopted flood plain zoning districts, wetlands protection programs, and other measures as well as enforcing the State building code, which has strong provisions related to hazard resistant building requirements. All current municipal mitigation measures must be documented.

4. Develop Mitigation Strategies – MAPC works with the local municipal staff to identify new mitigation measures, utilizing information gathered from the hazard identification, vulnerability assessments, and the community's existing mitigation efforts to determine where additional work is necessary to reduce the potential damages from hazard events. Additional information on the development of hazard mitigation strategies can be found in Chapter VII.

5. Plan Approval & Adoption – Once a final draft of the plan is complete it is sent to MEMA for the state level review and, following that, to FEMA for approval. Typically, once FEMA has approved the plan, the agency issues a conditional approval with the condition being adoption of the plan by the municipality. More information on plan adoption can be found in Chapter IX and documentation of plan adoption can be found in Appendix D.

6. Implement & Update the Plan – Implementation is the final and most important part of any planning process. Hazard Mitigation Plans must also be updated on a five- year basis making preparation for the next plan update an important on-going activity. Chapter IX includes more detailed information on plan implementation.

Public participation occurred at four levels; the North Shore Multiple Hazard Community Planning Team (regional committee) and the Swampscott Multiple Hazard Community Planning Team (local committee). In addition, the Town held two advertised meetings open to the general public to present the plan and hear citizen input. Following the presentation of the draft plan at the two public meetings, the draft was placed on the Town website for ten days for public comment and questions.

In addition, Swampscott was able to participate in a North Shore Natural Hazard Mitigation Plan Workshop held on September 14, 2011, sponsored jointly by MEMA, MA Coastal Zone Management and MAPC staff. The workshop was designed to help assist communities draft successful PDM plans, as well as providing a forum for sharing individual community plans on a regional basis; exploring inter-community questions, challenges and how to address them. See Appendix C.

Swampscott's Participation in the Regional Committee

On January 15, 2010, a letter was sent notifying the communities of the first meeting of the North Shore Regional Committee and requesting that the Chief Elected Official designate a minimum of two municipal employees and/or officials to represent the community. The following individuals were appointed to represent Swampscott on the regional committee:

Kevin Breen	Fire Chief/Emergency Management Director
Gino Cresta	DPW Director

The regional committee serves as an opportunity for neighboring communities to discuss hazard mitigation issues of shared concern. The North Shore Regional Committee met on February 8, 2010 at the Saugus Public Safety Building. At that meeting, representatives from each of the nine North Shore communities began the process of reviewing and revising their 2005 Hazard Mitigation Plans and were re-introduced to the following:

- The Massachusetts State Hazard Mitigation Plan and the FEMA hazard mitigation planning and grant process;
- The concept of each community engaging staff and the public to update its current Natural Hazard Mitigation Plan;
- FEMA plan overview and requirements and plan eligibility;
- The overall scope of work and plan revision schedule
- Questions about and discussion of local issues, inter-community and North Shore Region hazard mitigation issues and how to address them.
- Identifying and mapping municipal Critical Facilities, municipal Areas of Concern, Inter-Community Areas of Concern, and Regional Shared areas of Concern.
- Municipal representatives were also briefed on the importance of trying to create a diversified presence on the local Multiple Hazard Community Planning Team in advance of local team meetings, by contacting and inviting major employers, business owners, schools and non-profit organizations to participate in the process.

In addition, as the same group of MAPC staff is working on each community's plan, issues of shared concern, and other issues that may arise between neighboring communities, were discussed in greater detail in local committee meetings and resulting actions reflected in the identified mitigation measures, as noted in Chapter VIII.

The Local Multiple Hazard Community Planning Team

In addition to the regional committee meetings, MAPC worked with the local community representatives to organize a local Multiple Hazard Community Planning Team for Swampscott (local committee). MAPC briefed the local representatives as to the desired composition of that team as well as the need for representation from the business community and citizens at large.

The Local Multiple Hazard Community Planning Team Meetings

On March 28, 2011 MAPC conducted the meeting of the Swampscott Local Committee. The purpose of the meeting was to review the existing plan and mitigation goals, including gathering information on local hazard mitigation issues, updating existing mitigation practices, and determining the status of mitigation measures from the 2005 plan. The meeting also included discussion of new or modified mitigation measures and a process for public involvement and outreach. Table 3 lists the attendees at each meeting of the team. The agenda for these meeting is included in Appendix A.

Table 3.
Attendance at the Swampscott Local Committee Meeting

Name	**Representing**
March 28, 2011	
Kevin Breen	Fire Chief
James Potts	Fire Department
Gino Cresta	Director of Public Works

Public Meetings

The plan was introduced to the public at two public meetings, both while the draft plan was being completed. The public had an opportunity to provide input to the planning process during a meeting of the Swampscott Planning Board on February 6, 2012 held in the Swampscott High School. The hazard mitigation planning process and notice of the draft plan for review and comment was also given at a meeting of the Swampscott Board of Selectmen on March 14, 2012 at the Swampscott Senior Center.

Table 4.
Attendance at Public Meetings

Name	Representing
First Public Meeting, February 6, 2012	
Patrick Jones	Swampscott Planning Board, Chairman
Angela Ippolito	Swampscott Planning Board, Vice Chairman
Jeffrey Blonder	Swampscott Planning Board
George Potts	Swampscott Planning Board
Helen Kennedy	Swampscott Planning Board, Secretary
Sylvia Belkin	Swampscott Planning Board, Clerk
S. Peter Kane	Town Planner
Sam Cleaves	MAPC
Members of the public	
Second Public Meeting, March 14, 2012	
Matthew W. Strauss	Swampscott Board of Selectmen, Chairman
Jill G. Sullivan	Swampscott Board of Selectmen, Vice Chairman
Richard Malagrifa	Swampscott Board of Selectmen
Barry Greenfield	Swampscott Board of Selectmen
David S. Van Dam	Swampscott Board of Selectmen
Sam Cleaves	MAPC
Members of the public	

Both the Planning Board and Board of Selectmen meetings were advertised as public meetings. The attendance list for each meeting can be found in Table 4. In addition to staff and elected officials, approximately seven people attended the Planning Board meeting and five at the Board of Selectmen meeting. In addition, the plan was made available on the Town's website for public review following edits by the Swampscott Natural Hazard Mitigation Team. MAPC staff announced at both the Planning Board and Board of Selectmen public meetings that the draft plan would be available for comments and questions for a ten day posting period and encouraged Board members and public attendees to read the plan and submit comments.

The draft plan was posted on the Town's website for 10 days for public comment. The posting was announced at both the Board of Selectmen and Planning Board meeting. The Board of Selectmen meeting outlining the draft plan, how to get involved and how to submit comment on the draft, was televised and re-broadcast.

Local Stakeholder Involvement

Town staff was encouraged to reach out to local stakeholders that might have an interest in the Hazard Mitigation Plan including neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties. These stakeholders had an opportunity to participate in the public meetings, which was subject to the requirements of the Open Meeting Law requiring that the agenda for the meeting be advertised in a local paper of general circulation and posted in a public location. Town of Swampscott meeting agendas are also posted on the Town's website in advance of the meeting. The plan was also available on the web and the presentation from the public meeting shown on community cable, both easily accessible to the various local stakeholders that would have an interest in the plan.

Planning Timeline

January 15, 2010	Letter to the municipalities initiating the project.
February 8, 2010	Meeting of the North Shore Regional Committee
March 28, 2011	Meeting of the Local Committee
February 6, 2012	First Public Meeting in Town Hall
March 14, 2012	Second Public Meeting with the Board of Selectmen
November 21, 2012	Plan submitted to MEMA
July 2012- May, 2013-	MEMA Review Period and MAPC coordinates with Town on draft plan
May 7, 2013	MEMA Review Comments Received
May – August, 2013	MAPC coordinates with Town on revised draft plan
August 7, 2013	Revised Draft Plan Submitted to MEMA
March 7, 2014	FEMA Review Comments Received
March – August, 2014	Plan updated with new FIRM maps and ,Town data
August 12, 2014	Plan revised and submitted to MEMA
September 3, 2015	Revised plan submitted to MEMA
October 8, 2015	Approval Pending Adoption issued by FEMA

[This page intentionally left blank]

IV. RISK ASSESSMENT

The risk assessment analyzes the potential natural hazards that could occur within the Town of Swampscott as well as the relationship between those hazards and current land uses, potential future development, and critical infrastructure. This section also includes a vulnerability assessment that estimates the potential damages that could result from certain large scale natural hazard events.

Update Process

In order to update Swampscott's risk assessment, MAPC gathered the most recently available hazard and land use data and met with Town staff to identify changes in local hazard areas and development trends. Town staff reviewed critical infrastructure with MAPC staff in order to create an up-to-date list. MAPC also used the most recently available version of HAZUS (described below) and assessed the potential impacts of flooding using the latest data.

Overview of Hazards and Impacts

The Massachusetts Hazard Mitigation Plan 2010 (state plan) provides an in-depth overview of natural hazards in Massachusetts. The state plan indicates that Massachusetts is subject to the following natural hazards (listed in order of frequency); floods, heavy rainstorms, nor'easters or winter storms, coastal erosion, hurricanes, tornados, urban and wildfires, drought and earthquakes. Previous state and federal disaster declarations since 1991 are summarized in Table 2.

Table 5 summarizes the hazard risks for Swampscott. This evaluation takes into account the frequency of the hazard, historical records, and variations in land use. This analysis is based on the vulnerability assessment in the Commonwealth of Massachusetts State Hazard Mitigation Plan, 2010. The statewide assessment was modified to reflect local conditions in Swampscott using the definitions for hazard frequency and severity listed below Table 5.

Table 5 Hazard Risks Summary

Hazard	Frequency	Severity
Flooding	High	Serious
Dam failures	Low	Serious
Coastal Hazards	High	Serious
Tsunami	Very low	Extensive
Winter storms	High	Serious
Hurricanes	Medium	Serious
Tornadoes	Low	Serious
Brush fires	Medium	Minor
Earthquakes	Low	Extensive
Landslides	Low	Minor
Drought	Low	Minor
Extreme Temperature	Medium	Minor

Definitions used in the Commonwealth of Massachusetts State Hazard Mitigation Plan

Frequency

Very low frequency: events that occur less frequently than once in 1,000 years (less than 0.1% per year)
Low frequency: events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year);
Medium frequency: events that occur from once in 10 years to once in 100 years (1% to 10% per year);
High frequency: events that occur more frequently than once in 10 years (greater than 10% per year).

Severity

Minor: Limited and scattered property damage; no damage to public infrastructure (roads, bridges, trains, airports, public parks, etc.); contained geographic area (i.e. one or two communities); essential services (utilities, hospitals, schools, etc) not interrupted; no injuries or fatalities.

Serious: Scattered major property damage (more than 50% destroyed); some minor infrastructure damage; wider geographic area (several communities); essential services are briefly interrupted; some injuries and/or fatalities.

Extensive: Consistent major property damage; major damage public infrastructure damage (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities.

Catastrophic: Property and public infrastructure destroyed; essential services stopped, thousands of injuries and fatalities.

Flood Related Hazards

Flooding was the most prevalent serious natural hazard identified by local officials in Swampscott. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and, thunderstorms. Sea level rise and storm surges due to climate change have the potential to exacerbate these issues over time.

Regionally Significant Storms

There have been a number of major floods that have affected the North Shore region over the last fifty years. Significant historic flood events in Swampscott have included:

- March 1968
- The Blizzard of 1978
- January 1979
- April 1987
- October 1991 ("The Perfect Storm")
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007

- March 2010

Overview of Flooding

Coastal Flooding - Swampscott experiences some flooding of approximately 30% of the roadway network with every storm. Some of this is nuisance flooding although it sometimes results in roads being shut down. Atlantic Avenue at the Marblehead line experiences roadway flooding. The properties to the east of Atlantic Avenue are in the AO zone and those to the west of it are in the AE zone. The Town will shut down the roads if there is 6 inches of water or if the flooding has resulted in debris on the road.

There are no official evacuation routes; residents need to use the roads that are several blocks inland.

The 1991 "No-Name" storm resulted in damage to retaining walls and gravel being washed up on the roads. The town received disaster funds for the March, 2001 storm. A common problem is that the wind and waves of storms will pick up rocks and throw them through windows of buildings along the coast.

The 1978 storm was the worst storm that Swampscott has experienced. Flooding is particularly a problem at the Lynn/Swampscott line in the vicinity of Humphrey Street. This area is classified as being in the AO zone. During the 1978 storm, boats were required to get people in and out of this area. Another area of flooding is Puritan Road and Humphrey Street, particularly the 425 block of Forbes Square and the Fish House. Businesses in this area experience flooding. This area is classified as being in the AO zone.

Significant flood damage has also occurred in the residential area and private beach club at Shepherd and Ocean Streets. The sea wall at Blodgett Avenue has also failed. The beach club is in both the AO and AE zones while Blodgett Avenue is within the AO zone.

Upland Flooding – Upland flooding is becoming more of a problem because of increased runoff from new development. Flooding of Danvers Road has increased over time due to run off from the quarry, which is partly in Salem. Flooding is also an issue in the Stop and Shop parking lot at Vinnin Square. This flooding is due to runoff from the parking lot being channeled into an undersized pipe.

There are two bridges which cause flooding problems. The underpass of the Burrill Street Bridge floods during high tides because of debris build-up in the catch basin. In addition, the pitch of the roadway increases the flow of runoff to such an extent that the catch basin cannot handle the flow even if there is no debris. The second is the former railroad overpass on Stetson Avenue at Norfolk Avenue.

The homes along the entire length of Nason Road experience frequent backyard flooding. The abandoned railroad right-of-way which runs parallel to the street creates a damming effect which causes water to back up.

The Town considers the FEMA maps to be relatively accurate and most people in Town have flood insurance. A review of locally identified flood areas with the FEMA maps corroborates that most of

the areas of concern to the Town are in the AO zone.

Information on flood hazard areas was taken from two sources. The first was the National Flood Insurance Rate Maps. The FIRM flood zones are shown on Map 3 in Appendix B and defined below.

Flood Insurance Rate Map Zone Definitions

Zones A1-30 and AE: Special Flood Hazard Areas that are subject to inundation by the base flood, determined using detailed hydraulic analysis. Base Flood Elevations are shown within these zones.

Zone A (Also known as Unnumbered A Zones): Special Flood Hazard Areas where, because detailed hydraulic analyses have not been performed, no Base Flood Elevations or depths are shown.

Zone AO: Special Flood Hazard Areas that are subject to inundation by types of shallow flooding where average depths are between 1 and 3 feet. These are normally areas prone to shallow sheet flow flooding on sloping terrain.

Zone VE, V1-30: Special Flood Hazard Areas along coasts that are subject to inundation by the base flood with additional hazards due to waves with heights of 3 feet or greater. Base Flood Elevations derived from detailed hydraulic analysis are shown within these zones.

Zone B and X (shaded): Zones where the land elevation as been determined to be above the Base Flood Elevation, but below the 500 year flood elevation. These zones are not Special Flood Hazard Areas.

Zones C and X (unshaded): Zones where the land elevation has been determined to be above both the Base Flood Elevation and the 500 year flood elevation. These zones are not Special Flood Hazard Areas

The second source was discussions with local officials. The Locally Identified Areas of Flooding described below were identified by Town staff and other plan participants as areas where flooding is known to occur. These areas do not necessarily coincide with the flood zones from the FIRM maps. They may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone. The numbers correspond to the numbers on Map 8, "Hazard Areas". The numbers do not reflect priority order.

<u>Locally Identified Areas of Flooding</u>

1) Atlantic Avenue near Marblehead line: coastal storm surge/ high tides floods road and nearby homes

2) Shepard Avenue at Ocean Avenues: Palmer Pond overflow and neighborhood flooding due to coastal surge and high precipitation events

3) Puritan Road between Lincoln House Point and Smith Lane: coastal surge during winter storms and higher tides

4) Forbes Square (Humphrey Road at Fish House): access road allows coastal surge during storms and higher tides and floods area neighborhood

5) King's Beach: Stacy Brook storm drain outfall: flooding due to water backing up in storm drain from coastal surge

6) Stetson Avenue: flooding due to coastal surge onto low lying section of road

7) Burrill Street at MBTA Bridge: stormwater runoff flooding in low lying section of road under bridge

8) 413-465 Paradise Road (Vinnin Square Mall): low lying parking lot flood with precipitation events greater than 1.5 inches due to adjacent upland runoff

Repetitive Loss Structures

As defined by the Community Rating System (CRS) of the National Flood Insurance Program (NFIP), a repetitive loss property is any property which the NFIP has paid two or more flood claims of $1,000 or more in any given 10-year period since 1978. For more information on repetitive losses see http://www.fema.gov/business/nfip/replps.shtm. There are 44 repetitive loss structures in Swampscott as of February 28, 2014, the latest data available from MA DCR. , This is an increase from the 37 structures identified in the 2005 *Swampscott Hazard Mitigation Plan*. Of the 44 repetitive loss properties, 28 are located in a flood hazard zone, including 3 commercial properties and 25 residential properties.

Table 6. Repetitive Loss Properties Summary through 2/28/2014

	Total Properties	Claims	Building Losses $	Contents Losses $	Total Losses Paid $
Single Family	28	88	$1,230,344.82	$223,025.89	$1,453,370.71
2-4 Family	10	27	$144,091.65	$1559.40	$145,651.05
Other Residential	2	4	$52,760.97	0	$52,760.97
Commercial	4	13	$371,853.75	$53,033.16	$424,886.91
TOTAL	**44**	**132**	**$1,799,051.19**	**$277,618.45**	**$2,076,669.64**

Dams and Dam Failure

Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, which can affect life and property. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, or terrorism cause dam failures.

In recent years, dam failures in the United States have prompted renewed public and government concern and action. Public Law 92-367, the National Dam Inspection Act, resulted in the inventorying of dams in the United States and the inspection of non- federal dams nationally.

There have been no recorded instances of dam failure in Swampscott.

The only dam in Swampscott is Foster Dam. It is on an inland pond owned by the Town but located on the quarry property. It is not actually a dam but the banks of the pond are in danger of being over-topped under certain circumstances. It is not licensed by the DEP as a flood control dam. Foster Pond is within the Town's Flood Plain/Wetland Protection District and, while Aggregate Industries, owner of the quarry, discharges into the pond, the discharge is covered by an U.S. Environmental Protection Agency National Pollutant Discharge Elimination System permit. This federal permit allows the company to discharge storm water, process water, and ground water through one outfall to Foster Pond, subject to certain pollutant limitation and prohibitions. The DPW manages the pond outlet in that it maintains the discharge spillway and keeps it clear of obstruction to ensure flow through the pond system and into the municipal drain. The discharge from the pond flows in a westerly direction to Jackson Brook, a tributary to the Valley Road/Manson Street headwall. From the headwall, the water flows via a 72" concrete pipe to the Lynn Storm Sewer System which drains to King's Beach into the Atlantic Ocean.

The Swampscott Comprehensive Emergency Management Plan has a section on dam failure. The plan notes that dam failure in general is infrequent but has the potential for severe impacts. An issue for dams in Massachusetts is that many were built in the 19th century without the benefits of modern engineering or construction oversight.

The Massachusetts DCR has three hazard classifications for dams:

High Hazard:	Dams located where failure or mis-operation will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).
Significant Hazard:	Dams located where failure or mis-operation may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important facilities.
Low Hazard:	Dams located where failure or mis-operation may cause minimal property damage to others. Loss of life is not expected.

In general, DCR requires that dams that are rated as low hazard be inspected every ten years while dams that are rated as significant hazards must be inspected every five years.

Coastal Hazards

Erosion and flooding are the primary coastal hazards that lead to the loss of lives or damage to property and infrastructure in developed coastal areas. Coastal storms are an intricate combination of events that impact a coastal area. A coastal storm can occur any time of the year and at varying levels of severity. One of the greatest threats from a coastal storm is coastal flooding due to storm surge. This is the inundation of land areas along the oceanic coast and estuarine shoreline by seawaters over and above

normal tidal action.
High winds, erosion, heavy surf, unsafe tidal conditions, and fog are ordinary coastal hazard phenomena. Some or all of these processes can occur during a coastal storm, resulting in an often detrimental impact on the surrounding coastline. Storms including nor'easters and hurricanes, decreased sediment supplies, and sea-level rise contribute to these coastal hazards.

Hurricanes and Nor'easters

Hurricanes and Nor'easters are two storm types that impact the coast and coastal resources. For this report Hurricanes and Nor'easters are identified and analyzed as an atmospheric and winter related hazard.

A northeast coastal storm, known as a nor'easter, is typically a large counter-clockwise wind circulation around a low-pressure center often resulting in heavy snow, high winds, and rain. Nor'easters are a frequent coastal event for Massachusetts.

Hurricanes are relatively fast moving, rarely impacting the coast over multiple tidal cycles. When landfall is made, these concentrated, strong low-pressure systems usually pound south facing shores with high winds, precipitation, and storm surge. A Category 2 storm can cause millions of dollars in damage.

Characteristics or impacts of coastal storms

	Nor'easters	Hurricanes
Similarities		
	Economic Impacts Winds Surge and Wave Action Inland Flooding potentials	
Differences		
Duration	Lasting days on average	Lasting only hours
Season	October-May	August-October
Evacuations	Fewer coastal area evacuations, off season	Very populated coastal areas
Debris impacts	Less foliage	Full foliage

Source: 2010 Mass. State Hazard Mitigation Plan

Decreased Sediment Supplies

Coastal landforms such as coastal banks are essential to maintaining a supply of sediment to beaches and dunes. Where engineered structures are used to stabilize shorelines, the natural process of erosion is interrupted, decreasing the amount of sediment available and causing erosion to adjacent areas. Under conditions of reduced sediment, the ability of coastal resource areas such as dunes and beaches to provide storm damage prevention and flood control benefits is continually reduced. A major challenge is

to ensure that regional sediment supplies are managed effectively and in ways that allow the beneficial storm damage prevention and flood control functions of natural coastal processes to continue— both for future projects and, where possible, existing coastal development.

Location
In Swampscott, one example of infrastructure that impacts sediment supplies to beaches is the seawall that extends in back of Fisherman's Beach from Blaney Rock to just past Greenwood Avenue.

Coastal Erosion and Shoreline Change

Coastal shorelines change constantly in response to wind, waves, tides, sea level fluctuation, seasonal and climatic variations, human alteration, and other factors that influence the movement of sand and material within a shoreline system. The loss (erosion) and gain (accretion) of coastal land is a visible result of the way shorelines are reshaped in the face of these dynamic conditions. Shorelines tend to change seasonally, accreting slowly during the summer months when sediments are deposited by relatively low energy waves and eroding dramatically during the winter when sediments are moved offshore by high-energy storm waves, such as those generated by nor'easters. Regardless of the season, coastal storms typically cause erosion. With the anticipated change in climate an increase in intensity and frequency of storms is expected. This will, in turn, increase the likelihood of severe erosion episodes along the coast of Massachusetts.

Coastal erosion and shoreline change can result in significant economic loss through the destruction of buildings, roads, infrastructure, natural resources, and wildlife habitats. Damage often results from the combination of an episodic event with severe storm waves and dune or bluff erosion.

Some of the methods used by property owners to stop, or slow down, coastal erosion or shoreline change can actually exacerbate the problem. Attempting to halt the natural process of erosion with seawalls and other hard structures typically worsens the erosion in front of the structure, prevents any sediment behind the structure from supplying down drift properties with sediment and subjects down drift beaches to increased erosion. Without the sediment transport associated with erosion, some of the Commonwealth's and Swampscott's greatest assets and attractions – beaches, dunes, barrier beaches, salt marshes, and estuaries are threatened and will slowly disappear as the sediment sources that feed and sustain them are eliminated.

The Massachusetts Office Coastal Zone Management (CZM) has been collecting new data and studying and monitoring shoreline change. Additional information on shoreline change may be found in CZM's Fact Sheet on New Data on Shoreline Change online at http://www.mass.gov/czm/hazards/index.htm or http://www.mass.gov/czm/coastguide/online/index.htm

Location
Coastal Hazards are a Town-wide hazard in regard to hurricanes and nor'easters. In addition, many of the same areas in Swampscott vulnerable to coastal flooding are also subject to decreased sediment, coastal erosion and shoreline change including the following areas: Humphrey Street near the Lynn line, the intersection of Puritan Road and Humphrey Street, Forbes Square and the Fish House area near the Harbor.

Extent and Previous Occurrences

Erosion

Approximately 75 percent of the U.S. ocean shoreline is eroding. Massachusetts' ocean- facing shore is no exception. A study of shoreline change in Massachusetts by the U.S. Geological Survey, Woods Hole Oceanographic Institution Sea Grant Program, and Cape Cod Cooperative Extension reveals that approximately 68 percent, or 513 miles, of Massachusetts' ocean-facing shore exhibits a long-term erosion trend, 30 percent, or 226 miles, shows long-term accretion, and two percent, or 15 miles, shows no net change.

For the entire ocean-facing Massachusetts shore, from the mid -1800's to 1994, the long-term average annual shoreline change rate ranges between -0.58 and 0.75 feet per year.

Approximately 46 percent of the Massachusetts shore is eroding at one foot or less per year, while 22 percent of the shore is accreting at one foot or less per year. Eighty-one percent of the shore fluctuates +/-2 feet per year. Based on other studies (Pilkey & Thieler, 1992), 75 percent of the U.S. ocean shore is eroding, with the U.S. East Coast eroding at an average rate of 2-3 feet per year (Leatherman, 1993). Thus, Massachusetts' average annual shoreline change rate is lower than the East Coast average.

Figure 1. Historical Shoreline Change in Swampscott from 1844-2009

(See legend on next page)

Public Shoreline Stabilization Structures, 2009

Private Shoreline Stabilization Structures, 2013

Massachusetts Municipal Boundaries Labels

Shoreline Change Transects

High Water Shorelines (1800s-2009)
- 1844 – 1897
- 1909 – 1938
- 1943 – 1969
- 1970 – 1982
- 1994
- 2000
- 2001
- 2007 – 2009

Massachusetts Municipal Boundaries Lines
- Towns
- Interstate
- Coast

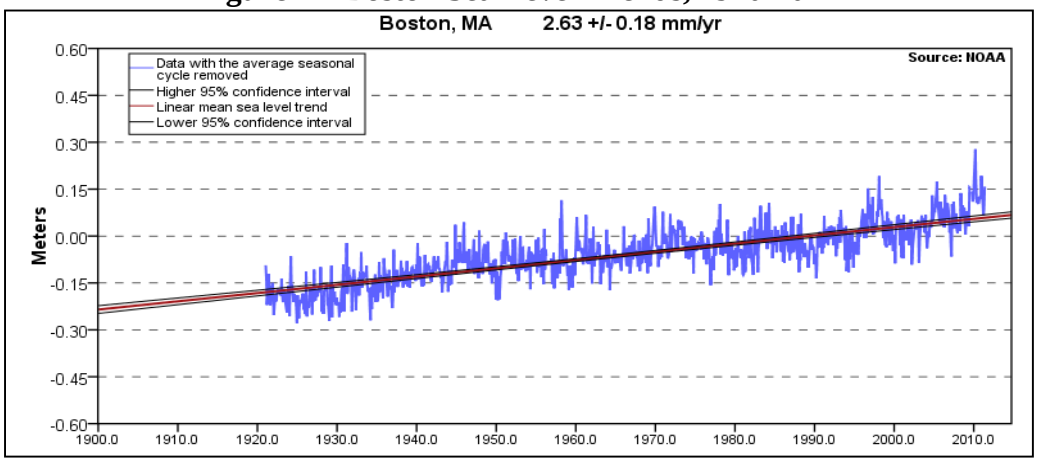
Geographic Place Names - Hypsographic Features

Source: MA CZM Shoreline Change Project

Sea Level Rise

A higher sea level increases the frequency and extent of coastal flooding. In the past 100 years, the relative change in sea level in nearby Boston Harbor has been a rise of about one foot (Figure 2). The change is relative, because it consists of two components: a rise in the absolute sea level and a sinking of the land. In the past 100 years, these two factors have been roughly equal, and, for the most part, represent long-term processes that have been underway since the end of the last Ice Age, approximately 14,000 years ago.

Figure 2 – Boston Sea Level Trends, 1920-2011



Source: National Oceanic and Atmospheric Administration (NOAA)

Climate change is accelerating the rate of global (absolute) sea-level rise (SLR) primarily by warming the oceans, causing the water already in them to expand, and by warming the land and air, causing ice on land (glaciers, ice sheets) to melt and flow into the ocean. A recent report as part of the U.S. National Climate Assessment states that there is "very high confidence (>9 in 10 chance) that global mean sea level will rise at least 0.2 meters (8 inches) and no more than 2.0 meters (6.6 feet) by 2100."[1] The low end of this range represents a continuation of the current trend, which has a relatively small contribution from melting ice. The higher end includes greater contributions from melting ice, for which there is an increasing amount of data, though still not enough to resolve some uncertainties. The report presents four scenarios of sea-level rise that could be used depending on the time frame of projects and the level of risk that communities are willing to accept. Whatever the actual amount of sea-level rise by the end of the century, the oceans will likely continue to rise after that.

Table 7- Global Sea-Level Rise Scenarios[2]

Scenario	SLR by 2100 (m)*	SLR by 2100 (ft)*
Highest	2.0	6.6
Intermediate-High	1.2	3.9
Intermediate-Low	0.5	1.6
Lowest	0.2	0.7

* Using mean sea level in 1992 as a starting point.

In addition to the rise of the global average, changes to the distribution of water around the globe will vary the amount of absolute sea-level rise that different localities experience. Changes in the temperature and salinity of water will affect ocean currents, and the melting of ice will alter the Earth's gravitational field. Both of these mechanisms could cause the Boston coastal region (and the Northeast coast overall) to see sea-level rise that, in the higher scenarios, is more than a foot greater than the global average. Early evidence of the predicted ocean-current effect was published in June 2012.[3]

Tables 8 and 9 show the extent of commercial and residential land that would be inundated by a range of 1-4 meters rise in sea level. Data is aggregate for Nahant, Lynn, Swampscott and Saugus.

Table 8. Commercial Inundation- Nahant, Lynn, Swampscott, Saugus

	Commercial/Industrial Inundation	% total Commercial
One Meter Inundation	104 Square Meters	0.16%
Two Meter Inundation	1231 Square Meters	1.90%
Three Meter Inundation	10472 Square Meters	16.15%
Four meter Inundation	22195 Square Meters	34.23%

*Total Commercial/Industrial Land: 64,842 Square Meters out of 700,530 total land area (9.26%)

[1] Parris, Adam, et al. *Global Sea Level Rise Scenarios for the United States National Climate Assessment*, NOAA Technical Report OAR CPO-1, National Oceanic and Atmospheric Administration, December 2012.

[2] ibid.

[3] Sallenger Jr, A. , K. Doran, P. Howd, "Hotspot of accelerated sea-level rise on the Atlantic coast of North America," Nature Climate Change (2012) 2, 884–888, doi:10.1038/nclimate159724, June 2012. See also, Parris et al., supra., for a summary of all contributing factors.

Table 9. Residential Inundation- Nahant, Lynn, Swampscott, Saugus

	Residential Inundated	%
One Meter Inundation	282 Square Meters	0.10%
Two Meter Inundation	2671 Square Meters	0.93%
Three Meter Inundation	11400 Square Meters	3.96%
Four meter inundation	18280 Square Meters	6.34%
*Total Residential Land: 288,105 Square Meters out of 700,530 total land area (41.13%)		

Source: *Sea Level Rise Inundation Impacts for Coastal Southern Essex County, MA* Joanna Orfanos, Phillip Shafovaloff, Simon Tolstopyatenko, December, 2009)

Probability of Future Coastal Hazard Events

Coastal hazards, excepting Hurricanes, are classified as High frequency events as defined by Table 5. Coastal Hazards are hazard events that may occur more frequently than once in 10 years, (greater than 10% per year). Hurricanes, also described in Wind Related Hazards, are classified as Medium frequency events, a hazard event that may occur from once in 10 years to once in 100 years (1% to 10% per year).

Atlantic Based Tsunami

FEMA defines tsunami as a series of enormous seismic sea waves created by an underwater disturbance caused by geologic activity in the form of earthquakes, volcanic eruptions, underwater landslides or meteorites striking the Earth. A tsunami can move hundreds of miles per hour in the open ocean and smash into land with waves as high as 100 feet or more. Earthquake induced movement of the ocean floor most often generates tsunamis. If a major earthquake or landslide occurs close to shore, the first wave in a series could reach the shore in a few minutes, even before a warning is issued. Coasts that are at greater risk are areas less than 25 feet above sea level and within a mile of the shoreline.

Location

Tsunamis are a Town-wide hazard. Tsunami wave action over the shore is variable and mainly dependent of the combination of both submarine and land topography in the area and the orientation of the arriving waves. The extent of damage and impact from tsunami depends upon the source and severity of onset on the tide cycle. As such, all of Swampscott would be considered vulnerable to coastal inundation from tsunami. Tsunamis were listed in the Massachusetts Hazard Mitigation Plan starting in 2010. Swampscott did not include Tsunamis in its 2005 Plan and does not have specific existing mitigation measures in place for the hazard.

Previous Occurrences

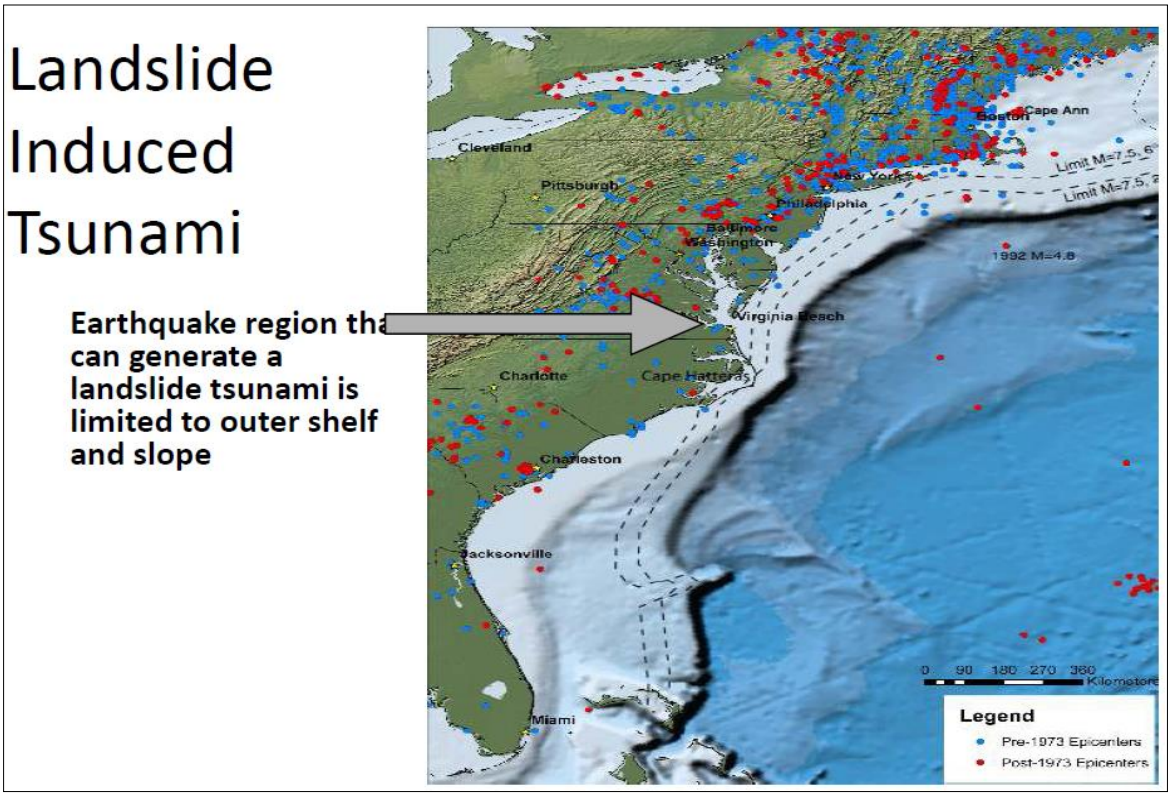
There have been no recorded instances of tsunamis in Essex County or Swampscott.

Probability of Future Occurrences

According to the West Coast and Alaska Tsunami Warning Center (WCATWC), an Atlantic based tsunami threat level for the US east coast is low when compared to the US Pacific and Caribbean coasts. Although the probability is low, a tsunami threat does exist and it is not out of the realm of possibility for the Atlantic. Geophysics specialists and geologists from the U.S. Geologic Survey and the Woods Hole Oceanographic Institute have researched Georges Bank Lower Slope of the western North Atlantic

and the relationship there between submarine landslides and earthquakes (see Figure 3). "The US Atlantic coast would be particularly vulnerable to devastation from tsunami because of the high density of population and infrastructure along its low lying coastal areas and estuaries."(Dr. Uri S ten Brink, et.al. Marine Geology 264, 2009, p.65) Further, Dr. ten Brink confirms that "the likelihood that a tsunami will hit this coast is fairly low. However, the most likely source will be a landslide that happens underwater at an area of about 215 miles offshore from Swampscott in an area known as the Continental Slope. This is the area that separates the very wide and shallow shelf. The shelf is about 100 to 150 meters from the deep ocean." The US Geologic Survey is researching the probability of a landslide on the Continental Shelf. Based on this assessment, the probability of a future tsunami hazard event in Swampscott is very low, an event that could occur less frequently than once in 1,000 years, less than 0.1% per year.

Figure 3 - Atlantic Based Tsunami- Potential Threat



Wind Related Hazards

Wind related hazards include hurricanes and tornados as well as high winds during severe rainstorms and thunderstorms. As with many communities tree loss and falling limbs, including downed power lines, are a serious hazard in Swampscott.

Between 1858 and 2000, Massachusetts has experienced approximately 32 tropical storms, nine Category 1 hurricanes, five Category 2 hurricanes and one Category hurricane. This equates to a

frequency of once every six years. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm

Hurricanes

There have been no tropical storms or hurricanes recorded to have passed through Swampscott Hurricanes typically have regional impacts beyond their immediate tracks, and numerous hurricanes have affected the communities of eastern Massachusetts (see Table 10). A hurricane or tropical storm track is the line that delineates the path of the eye of the hurricane or storm. Falling trees are a big problem because they can cause power outages when they fall on power lines or block traffic. Information on hurricanes is shown on Map 5 in Appendix B. There have been no significant changes to address hurricane emergency response since 2005. The two major mitigation measures in place are adherence to the Massachusetts State Building Code and the Town's Comprehensive Emergency Management Plan which addresses hurricane hazards although primarily from a response perspective.

Table 10. Hurricane Records for Massachusetts

Hurricane Event	**Date**
Great New England	September 21, 1938
Great Atlantic Hurricane*	September 14-15, 1944
Hurricane Doug	September 11-12, 1950
Hurricane Carol*	August 31, 1954
Hurricane Edna*	September 11, 1954
Hurricane Diane	August 17-19, 1955
Hurricane Donna	September 12, 1960
Hurricane Gloria	September 27, 1985
Hurricane Bob	August 19, 1991
Hurricane Earl	September 4, 2010
Tropical Storm Irene	August 28, 2011
Hurricane Sandy	October 29-30, 2012

*Category 3

Hurricane intensity is measured according to the Saffir/Simpson scale, which categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential. These are combined to estimate potential damage. The following gives an overview of the wind speeds, surges, and range of damage caused by different hurricane categories:

Scale No. (Category)	Winds(mph) Storm	Surge (ft)	Potential Damage
1	74 – 95	4 - 5	Minimal
2	96 – 110	6 - 8	Moderate
3	111 – 130	9 - 12	Extensive
4	131 – 155	13 - 18	Extreme
5	> 155	>18	Catastrophic

Source: NOAA

Table 11- Hurricane Disaster Declarations-includes Swampscott

Disaster	Title	Dates	Disaster
DR-751	Hurricane Gloria	9/27/1985	DR-751
DR-914	Hurricane Bob	8/19/1991	DR-914
EM-3252	Hurricane Katrina Evacuation	8/29/2005-10/1/2005	EM-3252
EM-3315	Hurricane Earl	9/1/2010-9/4/2010	EM-3315
EM-3350	Hurricane Sandy	10/29/12–10/30	EM-3350

It is important to note, that Hurricane Irene from August 21 – 30, 2011 and most recently Hurricane Sandy from October 22 – 31, 2012 fortunately did not track directly over Swampscott. Hurricane Sandy was a Category 3 hurricane at its peak intensity and weakened to a Category 2 off the northeastern Atlantic coast. Hurricane Sandy became the largest Atlantic hurricane on record with winds spanning 1,100 miles. Strong tropical force winds from the northeast quadrant of the post tropical cyclone, Sandy developed into a super storm nor'easter that impacted Swampscott and Essex County.

Swampscott suffered coastal flooding and storm surge, with low lying areas near Humphrey Street and Puritan Road suffering minor flooding. Fortunately, the peak of the hurricane coincided with low tide so flooding was minimized.

The impacts of the hurricane on Swampscott's coastal neighbor to the southwest, Lynn, as reported in the local newspaper and reprinted below, provides some idea of what Swampscott experienced. (There were no direct news reports found for Swampscott.)

> (Lynn) City officials designated the high school a city shelter Sunday evening, outfitted it with cots and provided food. City workers assigned to the school said nine people spent time there between 9 a.m. and 3:30 p.m.
>
> District Fire Chief Lawrence Godbout said emergency workers took a man struck on the head by a tree limb to Salem Hospital. The accident occurred on Jones Terrace off Boston Street at about 2:40 p.m. Wind damage and downed limbs calls came from locations across the city including Parrott Street, Boston Street near North Franklin Street, and Holyoke Street.
>
> Firefighters converged on 682 Summer St., Lynn, where high winds stripped part of the flat roof off a three-family apartment building.
>
> As of 5 p.m. Monday, National Grid listed 2,976 customers without power in Saugus; 988 in Lynn where outages were listed in the Highlands and off Lynnfield Street earlier in the day, and 904 in Revere.

Mayor Judith Flanagan Kennedy closed City Hall early after a telephone conference with the Massachusetts Emergency Management Agency. She said the MEMA update said winds would peak between 2 p.m. and 10 p.m.

National Grid reported 1,037 customers without power on its website shortly before 1 p.m. with some of the outages reported in the Highlands and near Harris Road off Lynnfield Street.

Lynn's Emergency Management Director, Thomas Hines, said four River Street residents voluntarily evacuated their homes shortly before 11 a.m. Monday out of concern for Saugus River flooding related to storm-related tidal surges.

State and Lynn police shut down Lynn Shore Drive to traffic from Nahant Street and Eastern Avenue shortly before 11 a.m. as Hurricane Sandy surged into the Drive's seawall, sending waves crashing into the Red Rock Park seawall." (Source: *Lynn Item*, Tuesday, October 30, 2012)

Tornados

A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. Because wind is invisible, you can't always see a tornado. A visible sign of the tornado is the dust and debris which can get caught in the rotating column made up of water droplets. Tornados are the most violent of all atmospheric storms.

Some ingredients for tornado formation include:

- Very strong winds in the mid and upper levels of the atmosphere
- Clockwise turning of the wind with height (i.e., from southeast at the surface to west aloft)
- Increasing wind speed in the lowest 10,000 feet of the atmosphere (i.e., 20 mph at the surface and 50 mph at 7,000 feet.)
- Very warm, moist air near the ground with unusually cooler air aloft
- A forcing mechanism such as a cold front or leftover weather boundary from previous shower or thunderstorm activity

Tornados can form from individual cells within severe thunderstorm squall lines. They can form from an isolated 'supercell' thunderstorm. They can be spawned by tropical cyclones or even their remnants that are passing through. And, weak tornados can even sometimes occur from air that is converging and spinning upward, with little more than a rain shower occurring in the vicinity.

Typically, there are 1 to 3 tornados somewhere in southern New England per year. Most occur in the late afternoon and evening hours, when the heating is the greatest. The most common months are June, July, and August, but the Great Barrington, MA tornado (1995) occurred in May and the Windsor Locks, CT tornado (1979) occurred in October. (2010 Mass. State Hazard Mitigation Plan)

Waterspout

A waterspout is a rapidly rotating column of air extending from the cloud base (typically a cumulonimbus thunderstorm) to a water surface, such as a bay or the ocean. There are two methods of formation.

First, unlike a tornado, waterspouts can form on a clear, sunny day if the right amount of instability and wind shear exists. These storms can have wind speeds ranging from 60 to 100 mph, but since they do not move very far, they can often be navigated around. These can become a threat to land if they do drift onshore.

A tornadic waterspout, on the other hand, is a true tornado that happens to be moving over water at the time (tornado over water). These form from the same processes that cause Tornados (see section above).

The National Weather Service issues a Special Marine Warning (SMW) for waterspouts over the coastal waters. They also issue a Tornado Warning (TOR) if a waterspout shows signs of moving toward land.

Between 1950 and 2011, no tornados were recorded in the Town of Swampscott; however, 101 tornados occurred within 50 miles of central Boston. Two of these were rated as an F3 and were within 36 miles of central Boston. A 1971 F1 tornado in the Town of Newton injured six people and caused one death (HIRA). The strongest tornado in Massachusetts history was the Worcester Tornado in 1953 (NESEC). A tornado caused significant damage in Springfield, resulting in 4 deaths in June of 2011.

On July 18, 2012 the National Weather Service in Taunton issued a Tornado Warning for Suffolk and Essex Counties. At 2:09 PM a waterspout was observed in Boston Harbor from Logan International Airport. According to Glenn Field, Warning Coordination Meteorologist at NOAA's National Weather Service office in Taunton, MA, "a supercellular storm structure, complete with rotating wall cloud formed out by Woburn and the rotation seen on radar prompted issuance of a tornado warning. The storm intensified further as it moved out to sea and we still think there was likely to have been an unreported waterspout farther off the coast, beyond the camera range. One and a half inch hail was reported in Nahant, 1.25 inch hail in Revere and Peabody. There was a funnel cloud reported by a very well trained amateur radio coordinator in Peabody. Federal Street was impassable from flooding in Lynn and there were a few trees downed as well."

Tornado damage severity is measured by the Fujita Tornado Scale, in which wind speed is not measured directly but rather estimated from the amount of damage. As of February 01, 2007, the National Weather Service began rating tornados using the Enhanced Fujita- scale (EF-scale), which allows surveyors to create more precise assessments of tornado severity. The EF-scale is summarized below in Figure 4.

Figure 4: Enhanced Tornado Fujita Scale

Fujita Scale			Derived		Operational EF Scale	
F Number	Fastest ¼ mile (mph)	3-second gust (mph)	EF Number	3-second gust (mph)	EF Number	3-second gusts (mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over -200

Tornados are a Town -wide hazard. Tornados tend to be quite rare in eastern Massachusetts and there have been no recorded tornados in the Town. There have been no changes since the 2005 NHM Plan to address tornados in Swampscott beyond maintaining emergency shelter in the event that they were needed.

The Town has adopted the Massachusetts State Building Code. The code's provisions are the most cost-effective mitigation measure against tornados given the lower probability of occurrence of a large tornado. The Town does maintain certified emergency shelters at the High School, Middle School and the Clarke School if they were needed in case of evacuations due to tornadoes or other emergencies. If a tornado were to occur in Swampscott, damages would be most likely be serious due to the prevalence of older construction and the density of development.

Previous Occurrences

Swampscott does not collect local data for tornado occurrence or related impacts to the community. Essex County data is the best available data to help understand previous occurrences, related impacts and the probability of future tornado hazard events. Essex County, which includes Swampscott, experienced 11 tornado events from 1950 – April 30, 2014. There were no reported deaths but four injuries were reported for Essex County and there was $562,780 in reported property damage. Nine of the tornados were F-1 magnitude and two were F-2. (NOAA National Climate Data Center)

On Monday, July 28, 2014 a tornado struck the City of Revere, MA which is located 6.15 miles away from Swampscott, though located in Suffolk County. There were several minor injuries but no deaths. Property damage estimates are preliminary but public property damages are thought to be at least $2 million dollars with private estimates still incomplete. The tornado was F-2 in magnitude and was on the ground for approximately four minutes in Revere.

Table 12- Essex County Tornados 1950 – 4/30/2014

County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD
ESSEX CO.	MA	08/21/1951	14:00	CST	Tornado	F2	0	0	2.50K
ESSEX CO.	MA	06/13/1956	15:45	CST	Tornado	F1	0	0	2.50K
ESSEX CO.	MA	11/21/1956	22:40	CST	Tornado	F2	0	0	25.00K
ESSEX CO.	MA	12/18/1956	09:15	CST	Tornado	F1	0	0	0.25K
ESSEX CO.	MA	07/13/1960	15:00	CST	Tornado	F0	0	0	0.03K
ESSEX CO.	MA	07/21/1962	17:00	CST	Tornado	F1	0	3	25.00K
ESSEX CO.	MA	05/19/1964	14:25	CST	Tornado	F0	0	0	2.50K
ESSEX CO.	MA	05/19/1964	14:35	CST	Tornado	F1	0	0	2.50K
ESSEX CO.	MA	08/10/1965	16:30	CST	Tornado	F1	0	0	0.00K
ESSEX CO.	MA	07/01/1968	19:00	CST	Tornado	F1	0	1	250.00K
ESSEX CO.	MA	07/21/1972	15:22	CST	Tornado	F1	0	0	2.50K
ESSEX CO.	MA	08/15/1991	16:35	EST	Tornado	F1	0	0	250.00K
TOTAL					**11**		**0**	**4**	**562.78K**

Probability of Future Tornado Events

Based on the record of previous occurrences since 1950, Tornado events in Swampscott are now a Medium frequency event as defined by the 2010 Massachusetts State Hazard Mitigation Plan. This hazard may occur from once in 10 years to once in 100 years, 1% to 10% per year.

Winter Storms

Winter snow storms and extended cold weather are frequent hazards in New England. Heavy snowfall impairs the flow of vehicles needed for day-to-day commuting, local businesses and public safety response. Swampscott has experienced several record breaking storms since the 1978 storm and has developed training, techniques and practices to efficiently deal with these events.

In Massachusetts, northeast coastal storms known as nor'easters occur 1-2 times per year. Winter storms are a combination hazard because they often involve wind, ice and heavy snow fall. The average annual snowfall for most of the Town is 48.1 inches to 72 inches.

The most significant winter storm in recent history was the "Blizzard of 1978," which resulted in over 3 feet of snowfall and multiple day closures of roadways, businesses, and schools. This winter storm heavily impacted the Essex County coastal areas. For instance, it damaged 25% of Revere's homes, left 3,000 people homeless, and flooded over 3,000 buildings in the Lynn, Revere, Saugus, and Malden area. (ACOE)

Historically, severe winter storms have occurred in the following years:

Blizzard of 1978	February 1978
Blizzard	March 1993
Blizzard	January 1996
Severe Snow Storm	March 2001
Severe Snow Storm	December 2003
Severe Snow Storm	January 2004
Severe Snow Storm	January 2005
Severe Snow Storm	April, 2007
Severe Snow Storm	December 2010
Severe Snow Storm	January 2011
Blizzard	February 2013

Source: National Oceanic and Atmospheric Administration

More recently, 2008 was a record year for snowfall. By the end of the February 2008, Boston's Logan International Airport broke a new February record for total precipitation. In March 2008, many cities and towns in Massachusetts exceeded the highest snowfall records. The above-average snowfall that season increased groundwater and surface water levels to a high level, and contributed to flooding experienced in spring 2008.

Because a major feature of winter storms is the tendency for higher tides with associated flooding, the same mitigation measures in place for flooding are all important for mitigating the impacts of winter storms. However, the rapid melting of snow after major storms, combined with rainfall, is more of a common flooding threat.

Managing snow removal can be an expensive and challenging task for a small community. Narrow streets, lack of off street parking options and limited areas to store plowed snow can hinder adequate plowing and emergency vehicle access. The DPW works to clear roads as requested by emergency service providers and carries on general snow removal operations. The MA Department of Transportation removes snow from Paradise Road, State Route 1A. Since 2005, the Town has also reduced its use of sand, opting for 100% salt, which reduces the sand which must be swept from the streets once winter has passed. The Town continues to ban on-street parking at nights during snow storm events and during snow removal to ensure that streets can be plowed and public safety vehicle access is maximized.

Information on winter storm related hazards can be found on Map 6 in Appendix B.

Previous Occurrences

The Town does not collect data on snow and blizzard events. Essex County, which includes Swampscott, is the best available data to help understand previous occurrences, related impacts and the probability of future snow and blizzard hazard events. According to present NCDC records, the County experienced one blizzard between 1950 and4/30/ 2014, in 2013, which resulted in no deaths or injuries but with$56,000 in property damage in Essex County. For the same time period, Essex County and Swampscott experienced 60 heavy snowfall event days, resulting in 0 deaths, no injuries and $7.313

million dollars in property damage. Using the NESIS scale for magnitude and the National Weather Service's definition of heavy snowfall, it can be deduced that Swampscott and heavily urbanized Essex County have experienced 60 NESIS Category 3 Major heavy snowfall events since 1950.

See Tables 13 and 14 below for Blizzard and Heavy Snow events and impacts.

Table 13. Blizzards and Impacts in Essex County

County/Zone	Date	Time	Type	Mag	Dth	Inj	PrD
EASTERN ESSEX (ZONE)	02/08/2013	18:00	Blizzard		0	0	56.00K
WESTERN ESSEX (ZONE)	02/08/2013	19:00	Blizzard		0	0	0.00K
TOTAL					0	0	56.00K

Table 14. Heavy Snow Events and Impacts in Essex County, 1950–4/30/2014

County/Zone	Date	Time	Type	Dth	Inj	PrD
EASTERN ESSEX (ZONE)	01/02/1996	21:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/02/1996	21:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	01/07/1996	17:00	Heavy Snow	0	0	1.000M
WESTERN ESSEX (ZONE)	01/07/1996	17:00	Heavy Snow	0	0	1.000M
EASTERN ESSEX (ZONE)	01/10/1996	00:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/12/1996	14:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	02/02/1996	22:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	02/16/1996	13:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/02/1996	10:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	03/02/1996	10:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	03/07/1996	10:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/07/1996	10:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	04/09/1996	18:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	04/09/1996	18:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	12/06/1996	08:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/06/1996	08:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	12/07/1996	16:00	Heavy Snow	0	0	1.360M
WESTERN ESSEX (ZONE)	12/07/1996	16:00	Heavy Snow	0	0	1.360M
EASTERN ESSEX (ZONE)	02/16/1997	21:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/31/1997	14:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	03/31/1997	22:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	04/01/1997	00:00	Heavy Snow	0	0	2.500M
EASTERN ESSEX (ZONE)	04/01/1997	00:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	11/14/1997	06:00	Heavy Snow	0	0	0.00K

County/Zone	Date	Time	Type	Dth	Inj	PrD
EASTERN ESSEX (ZONE)	11/14/1997	06:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/23/1997	09:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	12/23/1997	09:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	01/15/1998	21:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/15/1998	21:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/14/1999	00:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	01/14/1999	00:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/06/1999	15:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	03/06/1999	15:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/15/1999	00:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	03/15/1999	00:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	01/13/2000	06:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/13/2000	06:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	02/18/2000	12:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	02/18/2000	12:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/30/2000	13:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/20/2001	21:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	01/20/2001	21:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	02/05/2001	14:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	02/05/2001	14:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/05/2001	13:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	03/05/2001	13:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/09/2001	15:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	03/09/2001	15:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/30/2001	22:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/08/2001	23:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	02/01/2003	21:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	02/01/2003	21:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	03/16/2004	16:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/16/2004	16:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	02/21/2005	01:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/23/2006	10:45	Heavy Snow	0	0	20.00K
EASTERN ESSEX (ZONE)	12/13/2007	11:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/13/2007	11:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	12/16/2007	04:30	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/16/2007	04:30	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	12/19/2007	16:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/19/2007	16:00	Heavy Snow	0	0	0.00K

County/Zone	Date	Time	Type	Dth	Inj	PrD
EASTERN ESSEX (ZONE)	01/14/2008	04:00	Heavy Snow	0	0	28.00K
WESTERN ESSEX (ZONE)	01/14/2008	04:30	Heavy Snow	0	0	20.00K
WESTERN ESSEX (ZONE)	02/22/2008	12:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	02/22/2008	15:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	12/19/2008	13:50	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/19/2008	13:54	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/21/2008	07:48	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	12/31/2008	08:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/31/2008	08:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	01/11/2009	00:14	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/11/2009	03:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/18/2009	05:12	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/01/2009	23:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	03/01/2009	23:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/09/2009	04:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	12/20/2009	01:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/20/2009	01:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/18/2010	01:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	02/16/2010	08:40	Heavy Snow	0	0	15.00K
WESTERN ESSEX (ZONE)	02/16/2010	09:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/12/2011	02:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	01/26/2011	21:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/26/2011	22:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	02/08/2013	05:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	02/08/2013	06:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	03/07/2013	08:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/07/2013	08:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	03/18/2013	22:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	03/18/2013	23:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	12/14/2013	17:30	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/14/2013	17:30	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	12/17/2013	16:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	12/17/2013	16:00	Heavy Snow	0	0	0.00K
EASTERN ESSEX (ZONE)	01/02/2014	05:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/02/2014	05:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	01/18/2014	11:00	Heavy Snow	0	0	10.00K
EASTERN ESSEX (ZONE)	02/05/2014	03:00	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	02/05/2014	03:00	Heavy Snow	0	0	0.00K

County/Zone	Date	Time	Type	Dth	Inj	PrD
EASTERN ESSEX (ZONE)	02/13/2014	06:30	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	02/13/2014	06:30	Heavy Snow	0	0	0.00K
WESTERN ESSEX (ZONE)	02/18/2014	10:00	Heavy Snow	0	0	0.00K
TOTAL				**0**	**0**	**7.313M**

Fire Related Hazards

For the purposes of this plan, a wildfire is an uncontrolled fire occurring in a forested or grassland area. In the Swampscott, such fires rarely grow to the size of those seen more typically in the western U.S. As their name implies, these fires typically burn no more than the underbrush of a forested area. These fires present a hazard where there is the potential for them to spread into developed or inhabited areas, particularly residential areas where sufficient fuel materials might exist to allow the fire the spread into homes.

Extent

Wildfires in Massachusetts are measured by the number of fires and the sum of acres burned. The most recent data available for wildfires in Massachusetts, shown below in Figure 5 , indicates that the wildfire extent in Swampscott consists of less than .25 acres burned, with Swampscott experiencing between 0-20 recordable fires between 2001-2009.

Figure 5. MA Wildfires 2001-2009

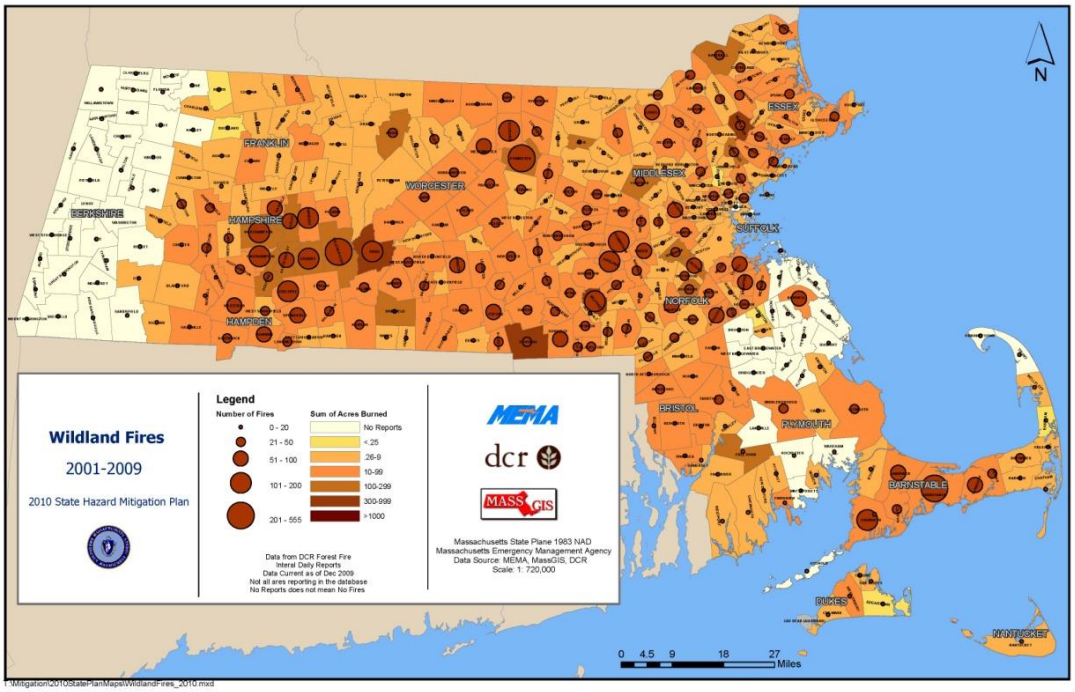
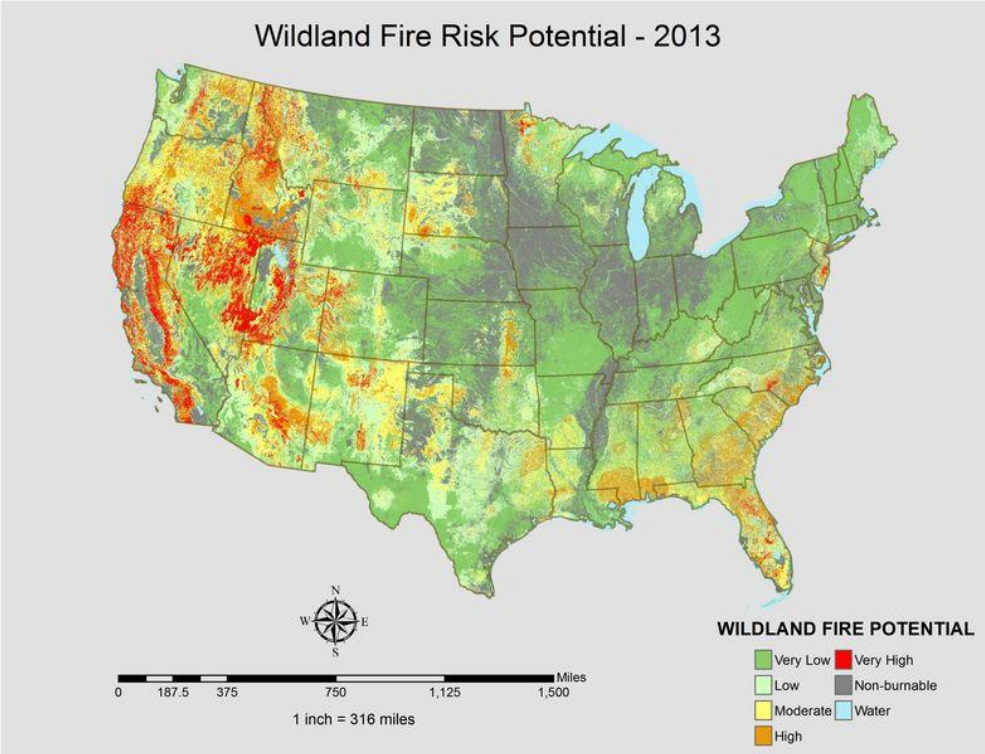


Figure 6 Wildland Fire Potential- 2013



The Town considers brush fires to be a medium priority natural hazard. Outdoor burning is allowed from January to May with a permit from the Fire Department. The Fire Department reviews all development proposals for fire safety. The Fire Department responds to approximately 3-5 wildfires annually. The Fire Department has never had any firefighter deaths due to wildfires or extensive damage to homes or commercial property. Most wildfires are caused by kids but this tends to be periodic and infrequent.

Wildfires are clustered in three areas in town. The old Machon School area wildfires are usually caused by kids playing with matches or lighters. The wooded area behind the Tedesco Country Club which backs up to the new middle school is another area. This has been less of a problem in recent years. The third area is the Harold King Forest which is owned by the Town and managed by the Conservation Commission. It abuts Lynn and Salem. This area has not been a problem for the last ten years but because the area is remote, fires could burn for a week. Fires in these three areas often burn the ground cover and then go underground and run through peat moss. Fighting these fires requires a boring nozzle to flood the area under high pressure.

Previous Occurrences/Impacts

The Town does not collect or maintain written records on the dates, exact locations, or impacts of wildfires. No injuries, deaths or property damage were associated with brush fires in Swampscott. The best available data used was for Essex County. From 1950 – April 30, 2014, there are no recorded Wildfire events for Essex County (NCDC: NOAA).

Probability of Future Wildfires

The probability of future Wildfires frequency is High, an event that can be expected to occur more frequently than once every 10 years, greater than 10% per year.

Geologic Hazards

Earthquakes

Earthquakes are a hazard with multiple impacts beyond the obvious building collapse. Buildings may suffer structural damage which may or may not be readily apparent.
Earthquakes can cause major damage to roadways, making emergency response difficult. Water lines and gas lines can break, causing flooding and fires. Another potential vulnerability is equipment within structures. For example, a hospital may be structurally engineered to withstand an earthquake, but if the equipment inside the building is not properly secured, the operations at the hospital could be severely impacted during an earthquake. Earthquakes can also trigger landslides.

Seismologists use a magnitude scale (Richter Scale) to express the seismic energy released by each earthquake. Table 15 includes the typical effects of earthquakes in various ranges.

Table 15 – Earthquake Effects

Richter Magnitudes	Earthquake Effects
Less than 3.5	Generally not felt, but recorded
3.5- 5.4	Often felt, but rarely causes damage
Under 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas up to about 100 km. across where people live.
7.0- 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or greater	Great earthquake. Can cause serious damage in areas several hundred meters across.

Source: Nevada Seismological Library (NSL), 2005

Although each earthquake has a unique magnitude, its effects will vary greatly according to distance, ground conditions, construction standards and other factors. In seismology, a scale of seismic intensity is a way of measuring or rating the *effects* of an earthquake at different sites. The Modified Mercalli Intensity Scale is commonly used in the United States by seismologists seeking information on the severity of earthquake effects. Intensity ratings are expressed as Roman numerals between I at the low end and XII at the high end (NSL 2005).

Table 16. Measuring Earthquake Magnitude (Modified Mercalli Intensity Scale)

Rating	Seismic Intensity/Effects
I	People do not feel any Earth movement.
II	A few people might notice movement if they are at rest and/or on the upper floors of tall buildings
III	Most people indoors feel movement. Hanging objects swing. Dishes, windows, and doors rattle. The earthquake feels like a heavy truck hitting the walls. A few people outdoors may feel movement. Parked cars rock.
IV	Almost everyone feels movement. Sleeping people are awakened. Doors swing open or close. Dishes are broken. Pictures on the wall move. Small objects move or are turned over. Trees might shake. Liquids might spill out of open containers.
V VI	Everyone feels movement. People have trouble walking. Objects fall from shelves. Pictures fall off walls. Furniture moves. Wall plaster might crack. Trees and bushes shake. Damage is slight in poorly built buildings. No structural damage.
VII	People have difficulty standing. Drivers feel their cars shaking. Some furniture breaks. Loose bricks fall from buildings. Damage is slight to moderate in well-built buildings; considerable in poorly built buildings
VIII	Drivers have trouble steering. Houses that are not bolted down might shift on their foundations. Tall structures such as towers and chimneys might twist and fall. Well-built buildings suffer slight damage. Poorly built structures suffer severe damage. Tree branches break. Hillsides might crack if the ground is wet. Water levels in wells might change.
VIX	Well-built buildings suffer considerable damage. Houses that are not bolted down move off their foundations. Some underground pipes are broken. The ground cracks. Reservoirs suffer serious Damage.
X	Most buildings and their foundations are destroyed. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, lakes. The ground cracks in large areas. Railroad tracks are bent slightly.
XI	Most buildings collapse. Some bridges are destroyed. Large cracks appear in the ground. Underground pipelines are destroyed. Railroad tracks are badly bent.
XII	Almost everything is destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move.

Source: NSL 2005 (Original Source: FEMA)

There have been no recorded earthquake epicenters within Swampscott. The Town enforces the MA State Building Code which is adequate in ensuring that new construction meets seismic standards. The Swampscott Fire Department also has mobile generators and light towers to assist with emergency power loss response in case of an earthquake.

According to the State Hazard Mitigation Plan, New England experiences an average of five

earthquakes per year. From 1668 to 2012, 355 earthquakes were recorded in Massachusetts, according to the Northeast States Emergency Consortium. Most have originated from the La Malbaie fault in Quebec or from the Cape Anne fault located off the coast of Rockport. The region has experienced larger earthquakes, of magnitude 6.0 to 6.5 in 1727 and 1755. Other notable earthquakes occurred here in 1638 and 1663 (Tufts University). Historical records of some of the more significant earthquakes in the region are shown in Table 17.

Table 17. - Historical Earthquakes in Boston or Surrounding Area, 1727-2012

Location	Date	Magnitude*
MA - Cape Ann	11/10/1727	5
MA - Cape Ann	12/29/1727	NA
MA – Cape Ann	2/10/1728	NA
MA – Cape Ann	3/30/1729	NA
MA – Cape Ann	12/9/1729	NA
MA – Cape Ann	2/20/1730	NA
MA – Cape Ann	3/9/1730	NA
MA - Boston	6/24/1741	NA
MA - Cape Ann	6/14/1744	4.7
MA - Salem	7/1/1744	NA
MA - Off Cape Ann	11/18/1755	6
MA – Off Cape Cod	11/23/1755	NA
MA - Boston	3/12/1761	4.6
MA - Off Cape Cod	2/2/1766	NA
MA - Offshore	1/2/1785	5.4
MA – Wareham/Taunton	12/25/1800	NA
MA - Woburn	10/5/1817	4.3
MA - Marblehead	8/25/1846	4.3
MA - Brewster	8/8/1847	4.2
MA - Boxford	5/12/1880	NA
MA - Newbury	11/7/1907	NA
MA - Wareham	4/25/1924	NA
MA – Cape Ann	1/7/1925	4
MA – Nantucket	10/25/1965	NA
MA – Boston	12/27/1974	2.3
VA –Mineral	8/23/2011	5.8
MA - Nantucket	4/12/2012	4.5
ME - Hollis	10/17/2012	4.0

Historical earthquakes without recorded magnitude were classified based on intensity using the Modified Mercalli Scale (intensity V or higher). Source: Boston HIRA

The Town has some un-reinforced, older masonry buildings which would be vulnerable in a severe earthquake. They include almost all Town schools and municipal service buildings except for the recently built high school.

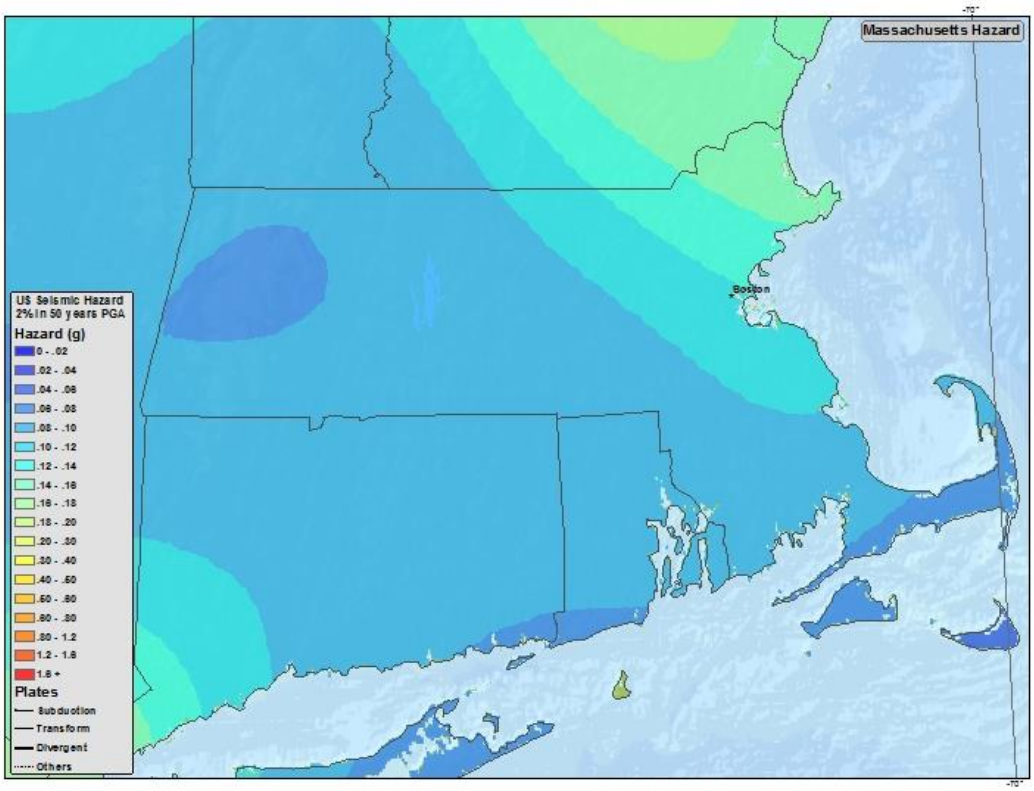
There have been no significant mitigation measures to address earthquake hazards since the 2005 NHM Plan, primarily because of the lower historical risk of a serious earthquake within the eastern MA region and because most mitigation resources are directed to flooding and coastal storm related issues. There have been no comments from the community regarding earthquakes.

Probability of Future Earthquake Events

Figure 7, the Mass. State Seismic Map, indicates the relative risks for experiencing an earthquake in different areas of the state. Swampscott's risk is indicated to be in the .10 - .12 hazard range. The Town's frequency of earthquake is projected to be Medium, with events that could occur from once every 10 years to once in 100 years (1% to 10% per year).

The USGS database shows that there is a 2.58% chance of a major earthquake of at least a 5.0 magnitude within 50km of Swampscott within the next 50 years. The largest earthquake within 30 miles of Swampscott, MA was a 3.1 Magnitude in 1999.

Figure 7 - 2014 Mass. State Seismic Hazard Map-Source: USGS



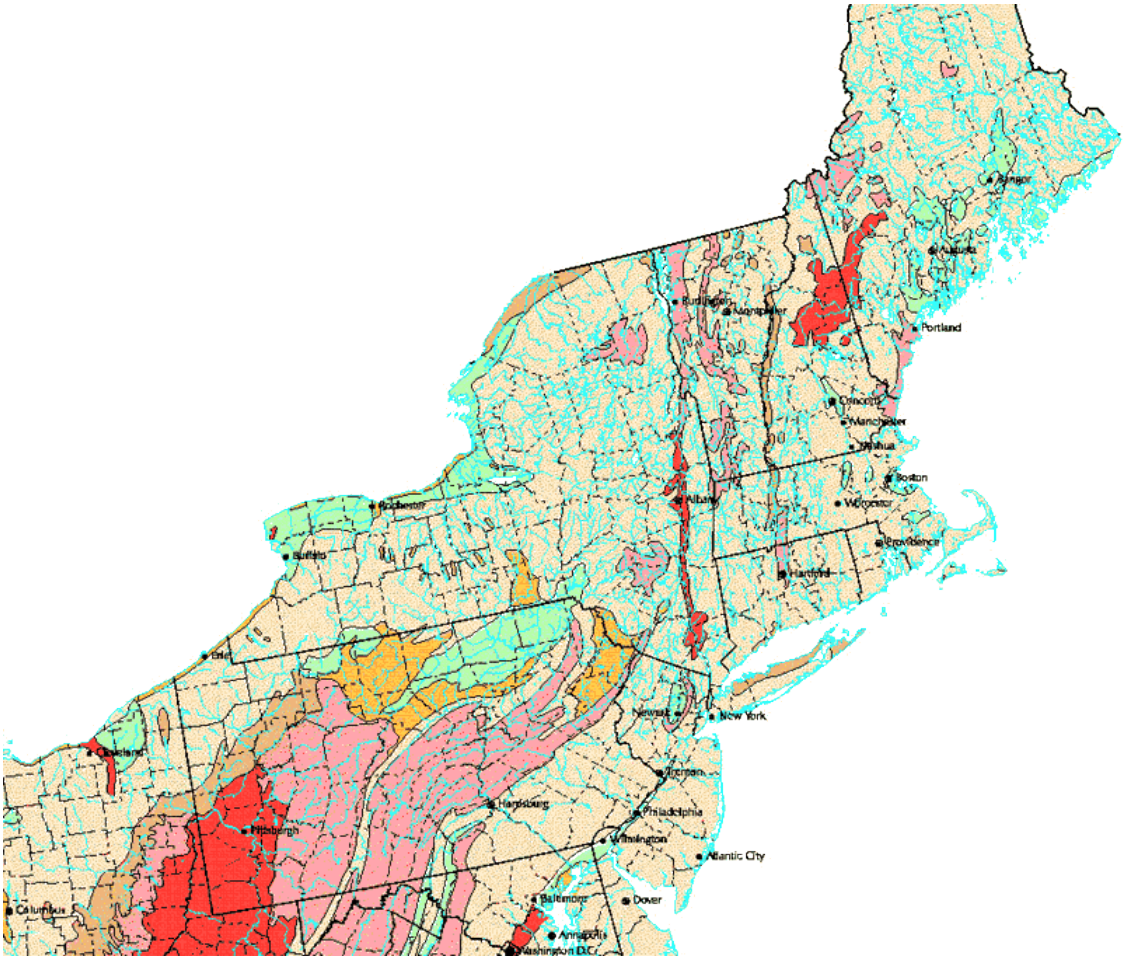
Landslides

Landslides can result from human activities that destabilize an area or can occur as a secondary impact from another natural hazard such as flooding. In addition to structural damage to buildings and the blockage of transportation corridors, landslides can lead to sedimentation of water bodies. The entire Town has been classified as having a low risk for landslides. The Town does not believe that landslides pose a high frequency risk to Swampscott and it has not taken actions regarding this hazard

since the 2005 Plan. The Town continues to try and make builders aware of erosion and landslide risks through the Building Department. There have been no documented occurrences of landslides in Swampscott.

See Figure 8, indicating the risk for landslide incidence and susceptibility/incidence for the Northeastern United States, including New England and Lynn. Map 4 in Appendix B shows further information on the incidence of landslide risk for Swampscott.

Figure 8. Landslide Overview Map of the Coterminous Eastern United States.



Reds= higher risk area Light brown=lower risk

Dorothy H Radbruch-Hall, Roger B. Colton, William E. Davies, Ivo Lucchitta, Betty A. Skipp, and David J. Varnes, 1982

Previous Occurrences

Swampscott does not collect data on landslide occurrences and there was no anecdotal evidence of landslides ever having occurred in Swampscott. The best available data was for Essex County. Between 1950 and April 30, 2014, Essex County experienced one landslide event, but suffered no deaths, injuries or property damage from landslides. (NOAA USCS).

Probability of Future Occurrences

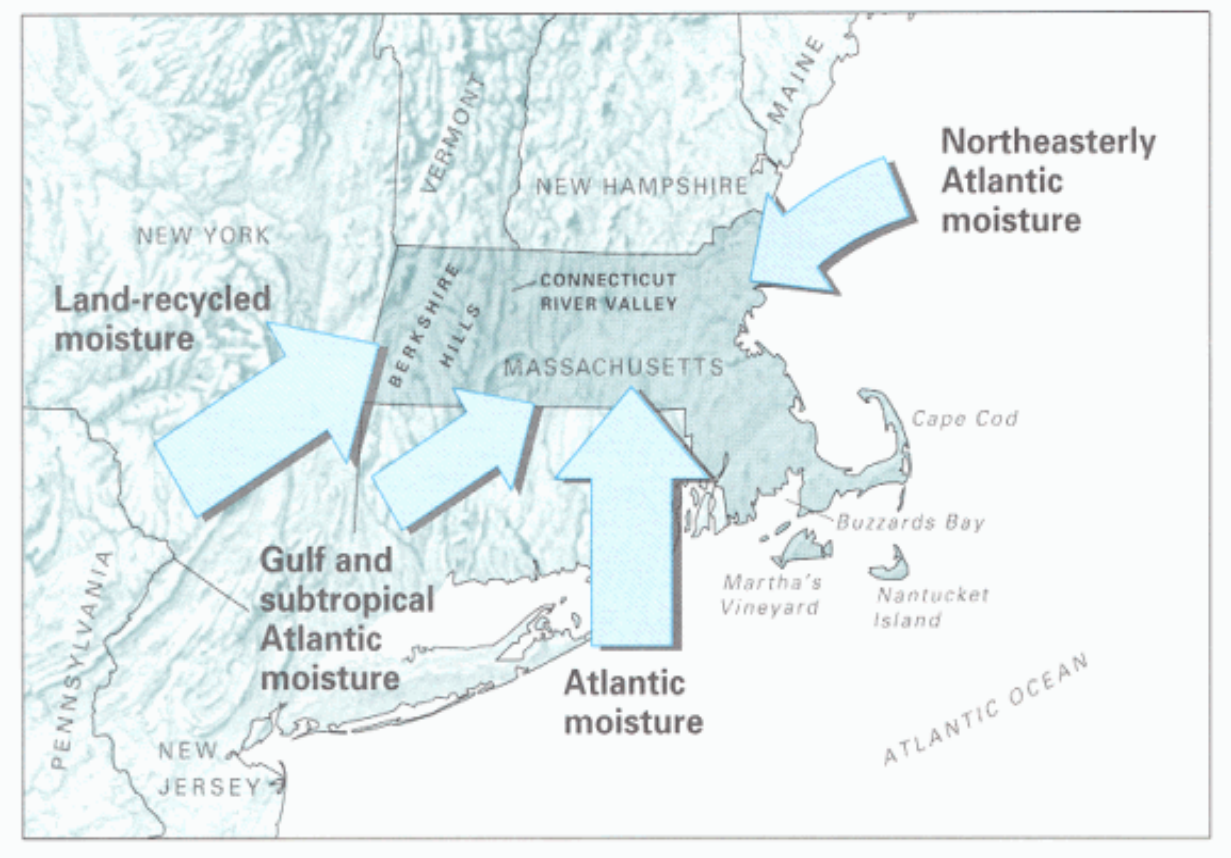
Based on past occurrences, landslides in Swampscott are of Very Low frequency, events that can occur less frequently than once in 1,000 years (less than 0.1% per year).

Drought

Drought is a temporary irregularity and differs from aridity since the latter is restricted to low rainfall regions and is a permanent feature of climate. Drought is a period characterized by long durations of below normal precipitation. Drought conditions occur in virtually all climatic zones yet its characteristics vary significantly from one region to another, since it is relative to the normal precipitation in that region. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.

In Massachusetts, droughts are caused by the prevalence of dry northern continental air and a decrease in coastal- and tropical-cyclone activity. During the 1960's, a cool drought occurred because dry air from the north caused lower temperatures in the spring and summer of 1962-65. The northerly winds drove frontal systems to sea along the Southeast Coast and prevented the Northeastern States from receiving moisture (U.S. Geological Survey Water-Supply Paper 2375, National Water Summary 1988-89--Floods and Droughts: Massachusetts Floods and Droughts). See Figure 9**.**

Figure 9. Principal Source and Pattern of Delivery of Moisture into Massachusetts:



U.S. Geological Survey Water-Supply Paper 2375, National Water Summary 1988-89, Floods and Droughts: Massachusetts

Although Massachusetts is relatively small, it has a number of distinct regions that experience significantly different weather patterns and react differently to the amounts of precipitation they receive. The DCR precipitation index divides the state into six regions: Western, Central, Connecticut River Valley, Northeast, Southeast, and Cape and Islands. Swampscott is located in the Northeast Region.

Average annual precipitation in Massachusetts is 44 inches per year, with approximately 3 to 4 inch average amounts for each month of the year. Swampscott averages 45.51 inches of rain per year. Regional monthly precipitation ranges from zero to 17 inches. Statewide annual precipitation ranges from 30 to 61 inches. Thus, in the driest calendar year (generally 1965), the statewide precipitation total of 30 inches was 68 percent of average.

Five levels of drought have been developed to characterize drought severity: Normal, Advisory, Watch, Warning, and Emergency. These drought levels are based on the conditions of natural resources and are intended to provide information on the current status of water resources. The levels provide a basic framework from which to take actions to assess, communicate, and respond to drought conditions. They begin with a normal situation where data are routinely collected and distributed, move to heightened vigilance with increased data collection during an advisory, to increased assessment and proactive education during a watch. Water restrictions might be appropriate at the watch or warning stage, depending on the capacity of each individual water supply system. A warning level indicates a severe situation and the possibility that a drought emergency may be necessary. A drought emergency is one in which mandatory water restrictions or use of emergency supplies is necessary.
Drought levels are used to coordinate both state agency and local response to drought situations.

As dry conditions can have a range of different impacts, a number of drought indices are available to assess these various impacts. Massachusetts uses a multi-index system that takes advantage of several of these indices to determine the severity of a given drought or extended period of dry conditions.

Drought level is determined monthly based on the number of indices which have reached a given drought level. In practice, the drought level designation has been based upon the condition in which the majority of the drought indices occur. That is, a majority of the indices would need to be triggered in a region in order for a drought designation for that region to move to a more severe level. Drought levels are declared on a regional basis for each of six regions in Massachusetts: Northeast, Southeast, Central, Connecticut River, Western, Cape Cod and Islands. County by county or watershed-specific determinations may also be made.

Once a drought level of warning and emergency have been reached for the precipitation index, conditions must improve to those of the previous level before a determination is made to reduce the warning or emergency.

A determination of drought level is based on seven indices:

- Standardized Precipitation Index: The Standardized Precipitation Index (SPI) reflects soil moisture and precipitation conditions.
- Crop Moisture Index: The Crop Moisture Index (CMI) reflects short-term soil moisture conditions as used for agriculture.
- Keetch-Byram Drought Index: The Keetch-Byram Drought Index (KBDI) is designed specifically for fire potential assessment. It is a number representing the net effect of

evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers.

Source: Res. Paper SE-38. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station. 32pp. Revised 1988.

Precipitation: The Precipitation Index is a comparison of measured precipitation amounts (in inches) to historic normal precipitation. Cumulative amounts for 3-, 6-, and 12-month periods are factored into the drought determination.

- Groundwater levels: The Groundwater Level Index is based on the number of consecutive months groundwater levels are below normal (lowest 25% of period of record for the respective months).
- Stream flow levels: The Stream flow Index is based on the number of consecutive months that stream flow levels are below normal (lowest 25% of period of record for the respective months).
- Index Reservoir levels: – The Reservoir Index is based on the water levels of small, medium and large index reservoirs across the state. The reservoir level relative to normal conditions for each month of the year will be considered.

Determinations regarding the end of a drought or reduction of the drought level focus on two key drought indicators: precipitation and groundwater levels. These two factors have the greatest long-term impact on stream flow, water supply, reservoir levels, soil moisture and potential for forest fires. Precipitation is a key factor because it is the overall cause of improving conditions. Groundwater levels respond slowly to improving conditions, so they are good indicators of long- term recovery to normal conditions.

A drought emergency will end when the conditions that led to the specific emergency have abated. For example, a critically low reservoir will need to have made a significant recovery, or groundwater wells will need to have returned to normal operating capacities. If an emergency has been declared based on environmental impacts, the emergency will end when these conditions have abated. (Massachusetts Drought Management Plan, 2013)

See Table 18. Mass. Drought Indices,: Source: Massachusetts Drought Management Plan, 2013

The Crop Moisture Index is subject to frequent change. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level.

****** Below normal for groundwater and streamflow are defined as being within the lowest 25th percentile of the period of record.

******* Water suppliers should be consulted to determine if below normal reservoir conditions are due to operational issues.

Location

Drought is a Town-wide hazard. Drought did not exist as a natural hazard category within the Massachusetts State Hazard Mitigation Plan when the Town completed its first plan in 2005 and so the 2005 plan does not contain any mitigation actions for drought..

Table 18. Mass. Drought Indices, Mass. Drought Management Plan- 2013

Drought Level	Standardized Precipitation Index	Crop Moisture Index*	Keetch-Byram Drought Index*	Precipitation	Groundwater	Streamflow	Reservoir***
Normal	3-month > -1.5 **or** 6-month > -1.0 **or** 12-month	0.0 to -1.0 slightly dry	< 200	1 month below normal	2 consecutive months below normal**	1 month below normal**	Reservoir levels at or near normal for the time
Advisory	3-month = -1.5 to -2.0 **or** 6-month = -1.0 to -1.5 **or** 12-month = -1.0 to –1.5	-1.0 to -1.9 abnormally dry	200-400	2 month cumulative below 65% of normal	3 consecutive months below normal**	At least 2 out of 3 consecutive months below normal**	Small index Reservoirs below normal
Watch	3-month < -2.0 **or** 6-month = -1.5 to -3.0 **or** 12-month = -1.5 to -2.0	-2.0 to –2.9 excessively dry	400-600	1 of the following criteria met: 3 month cum. < 65% **or** 6 month cum. < 70% **or** 12 month cum. < 70%	4-5 consecutive months below normal**	At least 4 out of 5 consecutive months below normal**	Medium index Reservoirs below normal
Warning	6-month < -3.0 **or** 12-month = -2.0 to -2.5	< -2.9 severely dry	600-800	1 of the following criteria met: 3 month cum. < 65% and 6 month cum. <65%, **or** 6 month cum. <65% and 12 month cum. <65%, **or** 3 month cum. <65% and	6-7 consecutive months below normal**	At least 6 out of 7 consecutive months below normal**	Large index reservoirs below normal
Emergency	12-month < -2.5	<-2.9 severely dry	600-800	Same criteria as Warning and previous month was	>8 months below normal**	>7 months below normal**	Continuation of previous month's conditions

Previous Occurrences

Swampscott does not collect data relative to drought events. Because drought tends to be more of a regional natural hazard, this plan references state data as the best available data for drought.

For summary purposes, this analysis of drought history in Massachusetts is limited to a statewide analysis. The statewide scale is a composite of six regions of the state: West, Connecticut River, Central, Northeast, Southeast, and Cape Cod and the Islands. Regional composite precipitation values are based on monthly values from six stations, and three stations in the smaller regions (Cape Cod/Islands and West). Because the statewide analysis will result in a muting of more extensive local drought impacts, this Drought History summary will likely underestimate the spatial frequency of droughts (i.e., droughts may occur more frequently in individual regions than depicted in the statewide analysis).

The attached graph (Figure 10) indicates incidents of drought levels' occurrence in Massachusetts using the SPI parameter alone. On a monthly basis, the state would have been in a Drought Watch to Emergency condition 11 percent of the time between 1850 and 2012.

Drought Emergency

Drought emergencies have been reached infrequently, with 5 events occurring in the period between 1850 and 2012: in 1883, 1911, 1941, 1957, and 1965-1966. The 1965-1966 drought period is viewed as the most severe drought to have occurred in modern times in Massachusetts given the period of record for precipitation data because of its long duration. On a monthly basis over the 162-year period of record, there is a one percent chance of being in a drought Emergency.

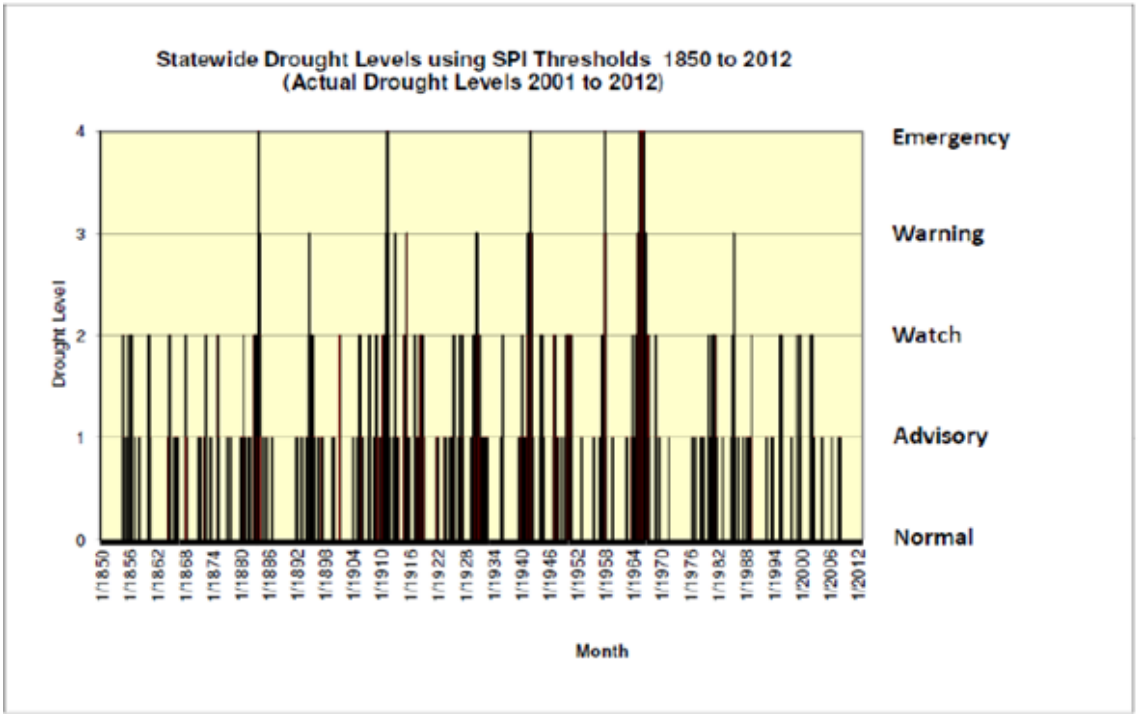
Drought Warning

Drought Warning levels not associated with drought Emergencies would have occurred in 1894, 1915, 1930, and 1985. On a monthly basis over the 162-year period of record, there is a two percent chance of being in a drought Warning level.

Drought Watch

Drought Watches not associated with higher levels of drought generally would have occurred in three to four years per decade between 1850 and 1950. The drought Emergency dominated the 1960s. There were no drought Watches or above in the 1970s. In the 1980s, there was a lengthy drought Watch level of precipitation between 1980 and 1981, followed by a drought Warning in 1985. A frequency of drought Watches at a rate of three years per decade resumed in the 1990s (1995, 1998, 1999). In the 2000s, Drought Watches occurred in 2001 and 2002. The overall frequency of being in a drought Watch is 8 percent on a monthly basis over the 162-year period of record.

Figure 10. Statewide Drought Levels using SPI Thresholds 1850 – 2012



(Source: Mass. State Drought Management Plan 2013)

Table 19. Chronology of Major Droughts in Massachusetts

Flood or drought	Date	Area affected (fig. 2)	Recurrence interval (years)	Remarks
Drought	1929-32	Statewide	10 to >50	Water-supply sources altered in 13 communities. Multistate.
Drought	1939-44	Statewide	15 to >50	More severe in eastern and extreme western Massachusetts. Multistate.
Drought	1957-59	Statewide	5 to 25	Record low water levels in observation wells, northeastern Massachusetts.
Drought	1961-69	Statewide	35 to >50	Water-supply shortages common. Record drought. Multistate.
Drought	1980-83	Statewide	10 to 30	Most severe in Ipswich and Taunton River basins; minimal effect in Nashua River basin. Multistate.
Drought	1985-88	Housatonic River basin	25	Duration and severity as yet unknown. Streamflow showed mixed trends elsewhere.

Probability of Future Occurrences

The state has experienced Emergency Droughts five times between 1850 and 2012. Even given that regional and local drought conditions may occur at a different interval than state data indicates, droughts remain primarily regional and state phenomena in Massachusetts. Swampscott can expect to experience Emergency Droughts at very close to the same frequency as its region and the state. Emergency Drought conditions over the 162 history of recorded droughts in Massachusetts have generated a Low Frequency natural hazard event, with events that can occur form once in 100 years to once in 1,000 years (0.1% to 1% per year).

Extreme Temperatures

There is no universal definition for extreme temperatures. The term is relative to the usual weather in the region based on climatic averages. Extreme heat, for this climatic region, is usually defined as a period of 3 or more consecutive days above 90 °F, but more generally a prolonged period of excessively hot weather, which may be accompanied by high humidity. Extreme cold, again, is relative to the normal climatic lows in a region.
Temperatures that drop decidedly below normal and wind speeds that increase can cause harmful wind-chill factors. The wind chill is the apparent temperature felt on exposed skin due to the combination of air temperature and wind speed.

Swampscott has four well-defined seasons. The seasons have several defining factors, with temperature one of the most significant. Extreme temperatures can be defined as those, which are far outside of the normal ranges for Massachusetts.

The average temperatures for Massachusetts are: Winter (Dec-Feb) Average = 31.8°F
Summer (Jun-Aug) Average = 71°F

Extreme Cold

Extreme cold is a dangerous situation that can result in health emergencies for susceptible people, such as those without shelter or who are stranded or who live in homes that are poorly insulated or without heat.

Lynn-Lowest recorded temperature: The lowest recorded temperature was -9°F in 2004.

Extreme Heat

The highest recorded temperature for Swampscott was 101°F in 2011.

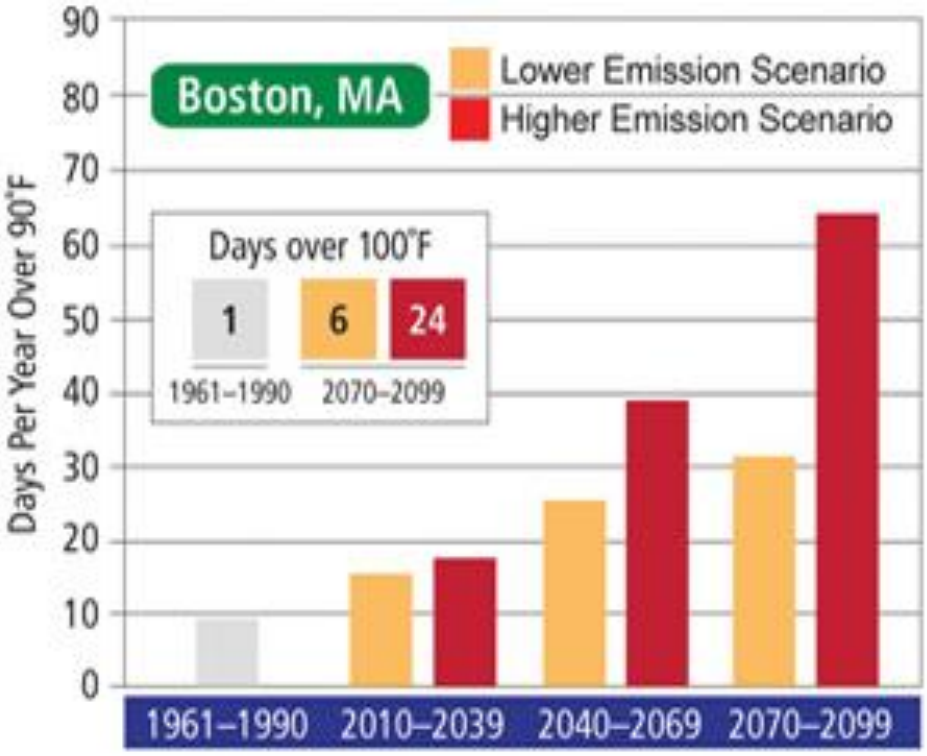
From 1979-2003, excessive heat exposure caused 8,015 deaths in the United States. During this period, more people in this country died from extreme heat than from hurricanes, lightning, tornados, floods, and earthquakes combined. Because most heat-related deaths occur during the summer, people should be aware of who is at greatest risk and what actions can be taken to prevent a heat-related illness or death. At greater risk are the elderly, children, and people with certain medical conditions, such as heart disease.

However, even young and healthy individuals can succumb to heat if they participate in strenuous physical activities during hot weather. Some behaviors also put people at greater risk: drinking alcohol; taking part in strenuous outdoor physical activities in hot weather; and taking medications that impair the body's ability to regulate its temperature or that inhibit perspiration.

Hot summer days can worsen air pollution, especially in urban areas. In areas of the Northeast that currently face problems with smog, inhabitants are likely to experience more days that fail to meet air quality standards. More frequent heat waves and lower air quality can threaten the health of vulnerable people, including the very young, the elderly, outdoor workers, and those without access to air conditioning or adequate health care. People who live in Northeastern cities are particularly at-risk, since the region is generally not as well adapted to heat as warmer regions of the country. Northeastern cities are likely to experience some of the highest numbers of heat-related illnesses and deaths, compared with the rest of the nation. (Source: EPA)

Essex County and Swampscott will experience an increase in the number of days over 100°F., depending on whether a higher or lower greenhouse gas emission scenario is met. Source: USGCRP (2009)

Figure 11.Projected Boston Days above 100 degrees F



Location

Extreme temperatures are a Town-wide hazard. They did not exist as a natural hazard category within the state hazard mitigation plan when the Town completed its first plan in 2005 and so the 2005 plan does not contain any mitigation actions for drought.

Previous Occurrences-Excessive Heat

The Town does not collect data on excessive heat occurrences. The best available data was for Essex County, including Lynn. From 1950- April 30, 2014, there has been a total of one excessive heat events in Essex County in 2011, with no reported deaths, injuries or property damage resulting from excessive heat. (NOAA: NCDC)

Previous Occurrences- Extreme Cold

Swampscott does not collect data for extreme cold occurrences. The best available data was for Essex County, including Lynn. For the period 1950 – 2014, Essex County experienced no recorded extreme cold/wind chill events. (NOAA: NCDC)

Probability of Future Occurrences- Extreme Temperatures

Extreme temperature events are projected to be Medium Frequency events with both extreme cold and hot weather events happening from between once in ten years to once in 100 years. Due to projected climate change, extreme hot weather events over 100 degrees Fahrenheit may become more frequent and extreme cold weather events less frequent.

Land Use and Development Trends

Existing Land Use

The most recent land use statistics available from the state are from aerial photography done in 2005. Table 20 shows the acreage and percentage of land in 33 categories. If the five residential categories are aggregated, residential uses make up 57 % of the area of the Town (1,131.29) acres). The highest percentage use is forest which comprises 17 % with 337.39 acres.

Table 20. Swampscott 2005 Land Use

Land Type	Acres	Percent
Cropland	0	0
Pasture	0	0
Forest	337.39	17
Wetland	43.07	2.17
Mining	47.10	2.37
Open Land	18.68	0.94
Participation Recreation	45.14	2.28
Spectator Recreation	0	0
Water-based Recreation	5.89	0.3
Multifamily Residential	253.48	12.77
High Density Residential	539	27.16
Medium Density Residential	269.7	13.59
Low Density Residential	61.9	3.12

Very Low Density Residential	7.21	0.36
Saltwater Wetland	0	0
Commercial	93.98	4.74
Industrial	3.57	0.18
Urban Open	0.4	0.02
Transportation	8.57	0.43
Waste Disposal	0	0
Water	11.76	0.59
Cranberry Bog	0	0
Power line	0	0
Saltwater Beach	50.43	2.54
Golf Course	74.97	3.78
Marina	0	0
Urban Public	57.23	2.88
Cemetery	22.25	1.12
Orchard	0	0
Nursery	0	0
Forested Wetland	27.57	1.39
Junkyards	0.78	0.04
Brush land/Succession	4.14	0.21
TOTAL	**1,984.21**	**100**

For more information on how the land use statistics were developed and the definitions of the categories, please go to http://www.mass.gov/mgis/lus.htm.

Regional Context, Natural Resources and Development

Swampscott has a total area of 6.7 square miles (17.4 km²), of which, 3.0 square miles (7.9 km²) of it is land and 3.7 square miles (9.6 km²) of it (54.83%) is water. Located beside Massachusetts Bay and the Atlantic Ocean, Swampscott lies along a mostly rocky shoreline, though there is enough clear shore for five beaches; Phillips' which stretches into Preston and is by far the largest beach in town, New Ocean House and Whales, Fisherman's, and a part of King's Beach, which extends into Lynn. There are several small parks, along with the small Harold King Forest in the northwest corner of town and the Tedesco Country Club which bisects part of the town. The town also has two small ponds, Foster Pond and Palmer Pond.

Swampscott is largely suburban in nature, with most of the clear land in the swampy northwest corner of town. There are three villages within town, Beach Bluff to the east, Phillips Point to the south, and Phillips' Beach inland between the two. The town is centered on Monument Square, designed by Frederick Law Olmsted; which is four miles south of Salem, twelve miles northeast of Boston, and twenty miles southwest of Cape Ann Swampscott is bordered by Marblehead to the northeast, Salem to the northwest, and Lynn to the west. The water rights of the town extend into Massachusetts Bay, bordered by those of Marblehead and Lynn.

Swampscott is located along Route 1A and Route 129. Both routes enter from Lynn, with Route 1A passing north of the town center towards Salem, and Route 129 following the coast for a half mile before going inland north of Phillips Point and returning to the coast before heading into Marblehead. There is no highway within town, which lies well south of Massachusetts Route 128 and Interstate 95. The town is served by MBTA bus routes which lead into the surrounding towns. Swampscott has a station along the Newburyport/Rockport Line of the MBTA Commuter Rail, with service from the North Shore to Boston's North Station. Another abandoned spur rail line crosses through the town towards Marblehead, where it has been converted into a bicycle path. The nearest air service can be reached at Beverly Municipal Airport, and the nearest national and international air service can be found at Boston's Logan International Airport.

Recent and Potential Future Development

MAPC consulted with Town staff to determine areas that have been or are likely to be developed in the future, defined for the purposes of this plan as a five year time horizon. These areas are shown on Map 2, "Potential Development" and are described below. The number for each site corresponds to the numbers on Map 2.

14) Fisher Avenue: approximately 6 single family homes, 20,000 square foot lots, built out in 2009, existing lots

15) New Police Station, 531 Humphrey Street: 1.65 acres, designed and scheduled for construction in 2012

16) 100 Burrill Street: 10-12 housing units, .25 acres, built

17) New High School, built 2007

Added through review and comment period but not mapped:

- 41 condo units at the old middle school, 71 Greenwood Avenue- being permitted as of September, 2012
- 14 single family, 55+ age units, redevelopment of Temple Israel site, 837 Humphrey Street, has been rezoned to allow permitting process to begin
- 16 units of 55+ development, vacant land between Archer St. and Vaughan Place
- 15 unit condo redevelopment at 235-253 Humphrey Street
- Church land redevelopment at 100 Burrill Street- church demolished but land now for sale , no construction started

Recent and Future Development in Hazard Areas

Table 21 shows the relationship of these parcels to two of the mapped hazards. This information is provided so that planners can ensure that development proposals comply with flood plain zoning and that careful attention is paid to drainage issues.

Table 21: Relationship of Potential Development to Hazard Areas			
ID	**Parcel**	**Landslide risk**	**Flood Zone**
14	Fisher Avenue	Low	No
15	New Police Station	Low	7.6003% in AO
16	100 Burrill Street	Low	No
17	New High School	Low	No

Critical Infrastructure in Hazard Areas

Critical infrastructure includes facilities that are important for disaster response and evacuation (such as emergency operations centers, fire stations, water pump stations, etc.) and facilities where additional assistance might be needed during an emergency (such as nursing homes, elderly housing, day care centers, etc.). These facilities are listed in Table 22 and are shown on all of the maps in Appendix B.

The purpose of mapping the natural hazards and critical infrastructure is to present an overview of hazards in the community and how they relate to critical infrastructure, to better understand which facilities may be vulnerable to particular natural hazards.

Table 22. Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall
1	Hanover Vinnin Square	apartment complex (two buildings w/ total of 184 units)	Low	No	No	Low
2	Clarke School	School	Low	No	No	Low
3	Trauma Ctr.	Medical Facility	Low	No	No	Low
4	National Grid Substation at Humphrey St	Power Substation	Low	No	No	Low
5	Fire Headquarters	Fire Station	Low	No	No	Low
6	Super Stop & Shop	Food/goods warehouse	Low	No	No	Low
7	Emergency Operations Center	EOC	Low	No	No	Low
8	National Grid Substation	Electric Substation	Low	No	No	Low
9	Bertram House Assisted Living	Special Needs	Low	No	No	Low
10	Town Administration Office	Municipal Facility	Low	No	No	Low
11	Whole Foods	Food/goods warehouse	Low	No	No	Low
12	Stanley School	School	Low	No	No	Low
13	Swampscott High School	School	Low	No	No	Low
14	Swampscott Housing Authority	Elderly Housing	Low	No	No	Low
15	Communication towers	Communication towers	Low	No	No	Low
16	Senior Center	Special Needs	Low	No	No	Low
17	Hadley School	School	Low	No	No	Low
18	National Grid Substation at Burrill Street	Substation	Low	No	Burrill Street at MBTA Bridge	Low
19	DPW	Municipal Facility	Low	No	No	Low
20	Water Tower	Municipal Facility	Low	No	No	Low

ID	NAME	TYPE	Landslide Risk	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall
21	Doherty Circle Elderly Housing	Special Needs	Low	No	No	Low
22	Police Station / 911	Police Station	Low	No	No	Low
23	Swampscott Public Library	Library	Low	No	No	Low
24	St. John's Church	Place of Worship	Low	No	No	Low
25	Swampscott Pier	Water Related Facility	Low	VE	Forbes Sq. (Humphrey Road at Fish House)	Low
26	Unitarian Universalist Church	Place of Worship	Low	No	No	Low
27	Phillips' Beach Ambulance	Ambulance	Low	No	No	Low
28	White Court	Former school-vacant	Low	No	No	Low
29	National Grid Substation at Paradise Road	Electric Substation	Low	No	No	Low
30	Heliport At Philips Park	Heliport	Low	No	No	Low
31	Public Boat Ramp	Public Boat Ramp	Low	AO	No	Low
32	Public Boat Ramp	Public Boat Ramp	Low	VE	Forbes Sq. (Humphrey Rd at Fish House)	Low
33	Water Pump Station	Water Pump Station	Low	No	No	Low
34	Cell Tower	Cell Tower	Low	No	No	Low
35	Foster Dam Spill Way	Dam	Low	No	No	Low
36	Windsor North Sewer Pump Station	Sewer Pump Station	Low	No	No	Low
37	Windsor South Sewer Pump Station	Sewer Pump Station	Low	No	No	Low
38	Sewer Pump Station	Sewer Pump Station	Low	No	No	Low

ID	NAME	TYPE	Landslide Risk	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall
39	Green Way Water Booster Pump Station	Water Pump Station	Low	No	No	Low
40	Post Office	Post Office	Low	No	No	Low
41	First Church Of Swampscott	Place of Worship	Low	No	No	Low
42	Church Of The Holy Name	Place of Worship	Low	No	No	Low
43	Chabad Lubavitch Of The North Shore	Place of Worship	Low	No	No	Low
44	Temple Shiat Hayam	Place of Worship	Low	No	No	Low
45	Swampscott Middle School	School	Low	No	No	Low
46	Sewer Pump Station	Sewer Pump Station	Low	No	No	Low
47	Aggregate Industries	Private Asphalt Plan	Low	No	No	Low
48	Galloupe's Point Sewer Pump Station	Sewer Pump Station	Low	VE	No	Low
49	Rocky Ledge Sewer Pumping Station	Sewer Pump Station	Low	No	No	Low
50	Little's Point Sewer Pump Station	Sewer Pump Station	Low	No	No	Low
51	King's Beach Boat Ramp	Boat Ramp	Low	VE	Kings Beach	Low
52	Fisherman's Beach Boat Ramp	Boat Ramp	Low	VE	Forbes Sq. (Humphrey Road at Fish House)	Low
53	Preston Beach Outfall	Beach	Low	VE	Atlantic Ave near Marblehead line	Low
54	Walgreens Pharmacy	Pharmacy	Low	No	No	Low
55	CVS Pharmacy	Pharmacy	Low	No	No	Low

ID	NAME	TYPE	Landslide Risk	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall
56	AT&T Cell Tower	Communications Tower	Low	No	No	Low
57	Essex St/ Boulder Way Bridge	Bridge	Low	No	No	Low
58	Danvers Road / Eastman Bridge	Bridge	Low	No	No	Low
59	Day Care in First Church Of Swampscott	Child Care	Low	No	No	Low
60	Hathaway School (Private)	School	Low	No	No	Low
61	Stacey Brook Storm Drain	Water Related Facility	Low	No	Kings Beach	Low
62	Phillips' Beach Outfall	Water Related Facility	Low	VE	No	Low
63	Swampscott Train Depot MBCR	Transportation Facility	Low	No	No	Low
64	Stetson Day Care	Child Care	Low	No	Stetson Ave.	Low
65	Play to Learn	Child Care	Low	No	No	Low
66	Temple Shirat Hayam Day Care	Child Care	Low	No	No	Low
67	Ocean Breeze Day Care	Child Care	Low	No	No	Low
68	Emergency Dispensing Site	Emergency Dispensing Site	Low	No	No	Low
69	Point of Distribution #1	Emergency Distribution Site	Low	No	No	Low
70	Point of Distribution #2	Emergency Distribution Site	Low	AO	No	Low
71	Humphrey Street Sewage Pump Station	Sewer Pump Station	Low	No	No	Low

Vulnerability Assessment

The purpose of the vulnerability assessment is to estimate the extent of potential damages from natural hazards of varying types and intensities. A vulnerability assessment and estimation of damages was performed for hurricanes, earthquakes, and flooding. The methodology used for hurricanes and earthquakes was the HAZUS-MH software. The methodology for flooding was developed specifically to address the issue in many of the communities where flooding was not solely related to location within a floodplain.

Introduction to HAZUS-MH

HAZUS- MH (multiple-hazards) is a computer program developed by FEMA to estimate losses due to a variety of natural hazards. The following overview of HAZUS-MH is taken from the FEMA website. For more information on the HAZUS-MH software, go to http://www.fema.gov/plan/prevent/hazus/index.shtm

> "HAZUS-MH is a nationally applicable standardized methodology and software program that contains models for estimating potential losses from earthquakes, floods, and hurricane winds. HAZUS-MH was developed by the Federal Emergency Management Agency (FEMA) under contract with the National Institute of Building Sciences (NIBS). Loss estimates produced by HAZUS-MH are based on current scientific and engineering knowledge of the effects of hurricane winds, floods and earthquakes. Estimating losses is essential to decision-making at all levels of government, providing a basis for developing and evaluating mitigation plans and policies as well as emergency preparedness, response and recovery planning.
>
> HAZUS-MH uses state-of-the-art geographic information system (GIS) software to map and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure. It also allows users to estimate the impacts of hurricane winds, floods and earthquakes on populations."

There are three modules included with the HAZUS-MH software: hurricane wind, flooding, and earthquakes. There are also three levels at which HAZUS-MH can be run. Level 1 uses national baseline data and is the quickest way to begin the risk assessment process. The analysis that follows was completed using Level 1 data.

Level 1 relies upon default data on building types, utilities, transportation, etc. from national databases as well as census data. While the databases include a wealth of information on the Town of Swampscott, it does not capture all relevant information. In fact, the HAZUS training manual notes that the default data is "subject to a great deal of uncertainty."

However, for the purposes of this plan, the analysis is useful. This plan is attempting to only generally indicate the possible extent of damages due to certain types of natural disasters and to allow for a comparison between different types of disasters. Therefore, this analysis should be considered to be a starting point for understanding potential damages from the hazards. If interested, communities can build a more accurate database and further test disaster scenarios.

Estimated Damages from Hurricanes

The HAZUS software was used to model potential damages to the community from a 100 year and 500 year hurricane event; storms that are .01% and .005% likely to happen in a given year and roughly equivalent to a Category 2 and Category 4 hurricane. The damages caused by these hypothetical storms were modeled as if the storm track passed directly through the Town, bringing the strongest winds and greatest damage potential.

Though there are no recorded instances of a hurricane equivalent to a 500 year storm passing through Massachusetts, this model was included in order to present a reasonable "worst case scenario" that would help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as we enter into a period of more intense and frequent storms.

Table 23.
Estimated Damages from Hurricanes

	100-year	**500-year**
Building Characteristics		
Estimated total number of buildings	5,229	5,229
Estimated total building replacement value (Year 2006 $) (Millions of Dollars)	$1,302	$1,302
Building Damages		
# of buildings sustaining minor damage	610	1,861
# of buildings sustaining moderate damage	86	857
# of buildings sustaining severe damage	4	172
# of buildings destroyed	2	104
Population Needs		
# of households displaced	22	278
# of people seeking public shelter	5	57
Debris		
Building debris generated (tons)	2,119.78	14,409.01
Tree debris generated (tons)	1,299.22	4,303.99
# of truckloads to clear building debris	85	574
Value of Damages (Thousands of dollars)		
Total property damage	$12,972.58	$126,659.63
Total losses due to business interruption	$1,477.84	$17,852.38

Estimated Damages from Earthquakes

Methodology Used

The HAZUS earthquake module allows users to define an earthquake magnitude and model the potential damages caused by that earthquake as if its epicenter had been at the geographic center of the study area. For the purposes of this plan, two earthquakes were selected: magnitude 5.0 and a magnitude 7.0. Historically, major earthquakes are rare in New England, though a magnitude 5 event occurred in 1963.

Table 24.
Estimated Damages from Earthquakes

	Magnitude 5.0	Magnitude 7.0
Building Characteristics		
Estimated total number of buildings	5,229	5,229
Estimated total building replacement value (Year 2002 $) (Millions of dollars)	$1,302	$1,302
Building Damages		
# of buildings sustaining slight damage	912	435
# of buildings sustaining moderate damage	296	1,630
# of buildings sustaining extensive damage	46	1,551
# of buildings completely damaged	6	1,559
Population Needs		
# of households displaced	40	2,227
# of people seeking public shelter	21	1,150
Debris		
Building debris generated (tons)	0.01 million	0.29 million
Value of Damages (Millions of dollars)		
Total property damage	$65.72	$871.83
Total losses due to business interruption	$6.05	$152.66

Estimated Damages from Flooding

Methodology Used

MAPC did not use HAZUS-MH to estimate flood damages in Swampscott. In addition to technical difficulties with the software, the riverine module is not a reliable indicator of flooding in areas where inadequate drainage systems contribute to flooding even when those structures are not within a mapped flood zone. In lieu of using HAZUS, MAPC developed a methodology to give a rough approximation of flood damages.

Swampscott is 6.7 square miles or 4,288 acres. Approximately 49 acres have been identified by local officials as areas of flooding. This amounts to 2.49 % of the land area in Swampscott. The number of structures in each flood area was estimated by applying the percentage of the total land area to the number of structures (5,229) in Swampscott; the same number of structures used by HAZUS for the hurricane and earthquake calculations. HAZUS uses a value of $235,486 per structure for the building replacement value. This was used to calculate the total building replacement value in each of

the flood areas.

The calculations were done for a low estimate of 10% building damages and a high estimate of 50% as suggested in the FEMA September 2002 publication, "State and Local Mitigation Planning how-to guides" (Page 4-13). The range of estimates for flood damages is $3,061,318 - $15,306,590. These calculations are not based solely on location within the floodplain or a particular type of storm (i.e. 100 year flood).

Table 25: Estimated Damages from Flooding

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area	# of Struc-tures	Replacement Value	Low Damage Estimate	High Damage Estimate
1	Atlantic Avenue near Marblehead line	5.6494	0.2847	15	$3,532,290	$353,229	$1,766,145
2	Shepard Avenue at Ocean Avenue	6.5029	0.3277	17	$4,003,262	$400,326	$2,001,631
3	Puritan Road between Lincoln House Point and Smith Lane	9.8011	0.4939	26	$6,122,636	$612,264	$3,061,318
4	Forbes Square (Humphrey Road at Fish House)	6.3887	0.3219	17	$4,003,262	$400,326	$2,001,631
5	King's Beach	9.5980	0.4837	25	$5,887,150	$588,715	$2,943,575
6	Stetson Avenue	3.3612	0.1694	9	$2,119,374	$211,937	$1,059,687
7	Burrill Street at MBTA Bridge	1.2740	0.0642	3	$706,458	$70,646	$353,229
8	413-465 Paradise Road (Vinnin Square Mall)	4.2738	0.2154	11	$2,590,346	$2,590,345	$1,295,173
9	Foster Pond Dam	2.5741	0.1297	7	$1,648,402	$164,840	$824,201
	Totals	**49.42**	**2.49051**	**130**	**$30,613,180**	**$3,061,318**	**$15,306,590**

(This page left intentionally blank)

V. HAZARD MITIGATION GOALS

The Swampscott Local Multiple Hazard Community Planning Team met on March 9, 2011. At that meeting, the team reviewed and discussed the goals from the 2005 Hazard Mitigation Plan for the Town of Swampscott.

The following ten goals were endorsed by the Team for the update of the Swampscott Hazard Mitigation Plan:

1. Ensure that critical infrastructure sites are protected from natural hazards.
2. Protect existing residential and business areas from flooding.
3. Prevent and reduce the damage to public infrastructure resulting from all natural hazards.
4. Continue to enforce existing zoning and building regulations.
5. Educate the public about zoning and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.
6. Encourage future development in areas that are not prone to natural hazards.
7. Educate the public about natural hazards and mitigation measures.
8. Make efficient use of public funds for hazard mitigation.
9. Protect the Town's ability to respond to various natural hazard events.

(This page left intentionally blank)

VI. EXISTING MITIGATION MEASURES

Existing Multi-Hazard Mitigation Measures

Comprehensive Emergency Management Plan (CEMP) – Every community in Massachusetts is required to have a Comprehensive Emergency Management Plan. These plans address mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies. These plans contain important information regarding flooding, hurricanes, tornados, dam failures, earthquakes, and winter storms. Therefore, the CEMP is a mitigation measure that is relevant to all of the hazards discussed in this plan.

Communications Equipment – The Town utilizes the MA emergency Incident Command Unit a mobile communications center available to the Town through the MA State Police and the MA Department of Fire Services. The Town has a Reverse 911 system in place, Connect CTY.

Emergency Power Generators – Emergency power generators are in place in the three Red Cross certified emergency shelters- the High School, Middle School and the Clarke School. One fire station and the DPW Facility have backup emergency generators.

Massachusetts State Building Code – The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood- proofing, and snow loads.

Southern Essex Regional Emergency Management Planning Committee (REPC) – Swampscott is a member of a regional emergency planning committee with Beverly, Danvers, Essex, Gloucester, Lynn, Manchester-by-the -Sea, Marblehead, Nahant, Peabody, Rockport, and Salem)

Existing Flood Hazard Mitigation Measures

The Town received an interest-free loan of $275,000 from the Department of Environmental Protection to do a Phase II Stormwater Management Plan in 2004. The Town hired the firm of Weston & Sampson to do a study of all of the outfalls that drain to the ocean. Some of these outfalls are simply pipes that drain to the ocean. The larger outfalls are equipped with flapper gates that shut when the tide is high and prevent water from flowing back into the Town during high tides. Some of these flapper gates are malfunctioning due to lack of maintenance and some have become filled with rocks.

Under the Stormwater Management Plan, the Town has updated the Philipp's Beach drainage outfall. As part of the inflow and infiltration stormwater work identified in the plan, Swampscott has worked to update its Eastern Avenue chlorination station as well as identified combined sewer overflow remediation options.

The Town has developed a warning system when storms are forecast. The Town will be using cable TV as well as a series of yellow and blue lights to alert residents. The activation of the blue lights indicates a parking ban and the white lights are used to alert residents to other situations requiring

their awareness. In addition, the town also has the capability to preempt all channels for cable subscribers with an emergency message.

The Town of Swampscott has a floodplain/wetland protection overlay district which has extensive provisions to prevent flood damage in floodplain areas. There is an additional coastal flood area overlay district to cover special flood hazard areas on the FIRM maps. The subdivision regulations also address flooding issues related to new subdivision development.

Enforcement of the existing zoning and building code regulations is considered to be an effective mitigation measure.

National Flood Insurance Program (NFIP) – Swampscott participates in the NFIP with 287 policies in force as of the June 30, 2015. FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website at http://www.fema.gov/policy-claim-statistics-flood-insurance/policy-claim-statistics-flood-insurance/policy-claim-13.

The following information is provided for the Town of Swampscott:

Flood insurance policies in force (as of June 30, 2015)	413
Coverage amount of flood insurance policies	$107,348,30
Premiums paid	$436,160
Total losses (all losses submitted regardless of the status)	354
Closed losses (Losses that have been paid)	285
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	69
Total payments (Total amount paid on losses)	$3,470,987

The Town complies with the NFIP by enforcing floodplain regulations, maintaining up- to-date floodplain maps, and providing information to property owners and builders regarding floodplains and building requirements.

Since the 2005 plan, the policies in force have increased by 209 and the total losses have increased by 84. The total payments, as of December 21, 2004, were $2,501,239.43, $969,748 less than the most recent figure.

Public Information & Outreach – The Town provides information on wetlands, copies of Flood Insurance Rate Maps and information on how to get more information regarding flood prone areas on its Conservation Commission web page.

Public Services Operations/Maintenance Activities – The Public Works Department actively maintains the Town's storm drain system. The following specific activities serve to maintain the capability of the drainage system through the reduction of sediment and litter build up and proper maintenance and repair.

- *Street sweeping* – Street sweeping is contracted out, with all streets being swept twice

per year.

- *Catch basin cleaning* –500 catch basins; each basin is cleaned every other year with clogged basins cleaned as needed. Swampscott has replaced several dysfunctional catch basins with new deep-sump basins over the last 10 years.

- *Roadway treatments* – Calcium Chloride is used for snow/ice treatment.

- *Drainage maintenance*- 100 % of the Town's catch basins and drain lines are now digitally mapped as of the end of 2011. The DPW tracks and records all catch basin maintenance and is in the process of digitizing the location of all drainage outfalls. The Engineering Department inspects streets and drainage systems once construction is completed. Private covenants for private, off-street drainage facilities are required. Routine maintenance and systematic replacement of drainage infrastructure part of the DPW's annual operating budget.

- *Open Space and Recreation Plan*- Swampscott is in the process of updating its Open Space and Recreation Plan.

Flood Plain District – Zoning is intended to protect the public health and safety through the regulation of land use. The Swampscott Zoning Bylaw includes a Flood Plain District/Wetland Protection Overlay District (FPWPOD) Section 4.2.0.0. The purposes of this district are:

- To prevent land subject to flooding from being used for development;
- To preserve and protect natural flow patterns and flood water storage capacity;
- To protect against cost incurred through the unsuitable use of wetlands;
- To conserve natural conditions, health and safety.

The FPWPOD was mapped in 1976 and allows agricultural, outdoor recreational, conservation, wildlife, existing buildings and certain temporary building uses.

No new structures or significant enlargement of existing structures, filling, dumping, excavation or mining is allowed in the FPWPOD though some uses are allowed by Special Permit, such as dams.

The Coastal Flood Area Overlay District (CFAOD), Section 4.2.0.0, was adopted by Swampscott to:

- Protect public safety;
- Eliminate new hazards to emergency response officials;
- Prevent public emergencies;
- Avoid loss of utility power services;
- Eliminate response and clean up costs;
- Reduce damage to property.

The CFAOD covers all Zone AE and VE areas on FIRM maps. For A zones, all new construction,

alterations, drainage and utilities activities must meet Section 3107 of the MA State Building Code. For V zones, all new development must be landward of mean high tide and meet all CFAOD requirements. All new construction in a V zone must have breakaway walls below the lowest floor space and must be elevated on anchored pilings. Some variations are allowed by Special Permit only. The Town updated its local CFAOD to reflect the new FEMA FIRM maps at its May, 2012 Town Meeting.

Wetland Ordinance- Chapter 16.04 of the Swampscott Code of Ordinances: The Town follows MGL Chapter 131 Section 40 *MA Wetlands Protection Act,* as well as state wetland regulations.

Site Plan Review- Under Section 5.4.0.0 Site Plan Special Permit, the Town requires review of some commercial, residential, parking, subdivisions and all adult uses. Storm drainage design must meet Swampscott's subdivision regulations.

Subdivision Control Drainage Regulations: The Swampscott Subdivision Regulations require that all new subdivision drainage be connected or extended to the Town's existing drainage system. The Environmental Impact Statement required for subdivision applications asks where the connection to the Town system will occur, the location of the outfalls, the effects of outfall and their discharge on receiving waters and the quantity of storm water to be discharged.

Mosquito Control Ditch Maintenance – Town representatives noted that the mosquito control district had a program of ditch cleaning that helped keep drainage ditches clear of debris. With the advent of West Nile virus and EEE, the mosquito control district has shifted funding from maintenance to monitoring and spraying. The result is that drainage ditches are not as well maintained.

DCR dam safety regulations- Applies to Foster Pond Dam, the only dam located in Swampscott.

Existing Wind Hazard Mitigation Measures

CEMP – The Swampscott Comprehensive Emergency Management Plan contains a section on hurricanes. It lists five generic mitigation measures:

- Develop and disseminate emergency public information and instructions concerning hurricane preparedness and safety.

- Community leaders should ensure that Swampscott is enrolled in the National Flood Insurance Program.
- Develop and enforce local building codes to enhance structural resistance to high winds and flooding. Build new construction in areas that are not vulnerable to direct hurricane effects.
- Review National Flood Insurance Rate Maps and Hurricane Evacuation Maps for possible impact on the community.
- Maintain plans for managing all hurricane emergency response activities.

The Swampscott CEMP outlines three generic mitigation measures for tornados.

- Develop and disseminate emergency public information and instructions concerning tornado

safety, especially guidance regarding in-home protection and evacuation procedures, and locations of public shelters.

- Strict adherence should be paid to building code regulations for all new construction.
- Maintain plans for managing tornado response activities. Refer to the non- institutionalized, special needs and transportation resources listed in the Resource Manual.

Massachusetts State Building Code – The Town enforces the Massachusetts State Building Code whose provisions are generally adequate to protect against most wind damage. The code's provisions are the most cost-effective mitigation measure against tornados given the extremely low probability of occurrence. If a tornado were to occur, the potential for severe damages would be extremely high.

Tree-trimming program – The Town contracts out 100% of its work to trim and remove trees as needed and grind stumps. National Grid maintains its power line corridors.

Additional mitigation measures in place include:

Swampscott now has backup power generators at key public facilities and utility sites.

The Town places power lines underground during new construction to avoid storm damage.

Existing Winter Hazard Mitigation Measures

Snow disposal – Regular plowing and snow/ice removal. Calcium chloride is used primarily for road treatments. Sand is very rarely used as it creates siltation and clean up problems. The DPW works to clear roads as requested or in an emergency for the Fire and Police Departments.

Existing Brush Fire Hazard Mitigation Measures

Burn Permits – The Town fire department allow outdoor burning with permit from January to May.

Fire Response-Swampscott responds to a brush fire or marsh fire in the same manner as other fire calls. It does not have a dedicated Forestry Division.

Subdivision/Development Review – The Fire Department participates in the review of new subdivisions and development projects.

Existing Geologic Hazard Mitigation Measures

Massachusetts State Building Code – The Town enforces the State Building Code. It contains a section on designing for earthquake loads (780 CMR 1612.0). Section 1612.1 states that the purpose of these provisions is "to minimize the hazard to life to occupants of all buildings and non-building structures, to increase the expected performance of higher occupancy structures as compared to ordinary structures, and to improve the capability of essential facilities to function during and after an earthquake". This section goes on to state that, due to the complexity of seismic design, the criteria presented are the minimum considered to be "prudent and economically justified" for the protection

of life safety. The code also states that absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, cannot be achieved economically for most buildings.

Section 1612.2.5 sets up seismic hazard exposure groups and assigns all buildings to one of these groups according to a Table 14 12.2.5. Group II includes buildings which have a substantial public hazard due to occupancy or use and Group III are those buildings having essential facilities which are required for post-earthquake recovery, including fire, rescue and police stations, emergency rooms, power-generating facilities, and communications facilities.

In the event of an earthquake and fires caused by it, 100 % of Swampscott is served by fire hydrants. The Town has six mobile generators in case of power loss and two mobile light towers.

Table 26.- Swampscott Existing Mitigation Measures

Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
MULTIPLE HAZARDS			
Comprehensive Emergency Management Plan (CEMP)	Town-wide.	Emphasis is on emergency response.	None. Plan is up t o date.
Communications Equipment: • Reverse 911-Connect CTY • Member of NERAC and NEMWIC	Town-wide.	Effective	Incident Command Unit. Evacuation/intersection sign-boards. Create regionalized dispatch facility with Lynn and Nahant. Install new radio repeaters for police/fire and DPW on roof of closed Greenwood Avenue School.
Massachusetts State Building Code	Town-wide.	Effective for new construction.	None

Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
Emergency Power Generators	High School, Middle School and Clarke School	Effective.	Upgrade generators as needed; provide generators at additional locations; provide alternative fuel sources and generator power source flexibility. Install fixed generator at Town Hall facility.
Participation in the Southern Essex Region Emergency Management Planning Committee	Town-wide	A forum for cooperation on natural and manmade disasters.	None
FLOOD HAZARDS			
2005 Stormwater Management Plan	Town-wide	The Town made extensive drainage infrastructure upgrades since 2005.	Additional resources are needed to implement further upgrades.
Participation in the National Flood Insurance Program (NFIP)	Areas identified on the FIRM maps	There are 413 policies in force as of 6/30/2015.	Encourage all eligible homeowners to obtain insurance; add more public outreach about program availability and new FIRM maps.
Town Engineering Department inspects all streets and drainage systems once construction is completed.	Town Wide	Effective	None
Public Services Operations/Maintenance	Town-wide	Effective	None
Open Space and Recreation Plan	Town Wide	Somewhat Effective	Complete drafting of new plan.
Flood Plain District/Wetland Protection Overlay District	Town Wide	Effective	None
Coastal Flood Area Overlay District	Town Wide	Effective	Use in conjunction with revised FIRM maps.
Wetland Ordinance	Town-wide	Effective	Consider adding wetland regulations.

Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
Site Plan Review	Town-wide	Effective	Consider adding reference to MA Stormwater Management Standards.
Subdivision Rules and Regulations for drainage	Town-wide	Somewhat Effective.	Consider adding reference to MA Stormwater Standards.
DCR Dam Safety	Foster Pond Dam	Effective.	None
WIND HAZARDS			
CEMP	Town-wide	Effective	None
The Massachusetts State Building Code	Town-wide	Effective for most situations except severe storms.	None
Tree trimming program and power line corridor maintenance.	Town-wide	Satisfactory	Front-end loader with grappling attachment needed to clear roads of downed trees.

Type of Existing Mitigation Measures	Area Covered	Effectiveness/ Enforcement	Improvements/ Changes Needed
Backup generator capacity in place at key public facilities.	Town-wide	Effective	Update existing generators as needed and add fixed generator capacity to Town Hall.
WINTER HAZARDS			
Snow Removal	Town-wide	Effective.	Construct new salt storage shed.
BRUSH FIRE HAZARDS			
Outdoor burning is allowed by permit only.	Town-wide.	Effective.	Brush fire truck and pump needed.
Water availability: 100 % of Town is served by hydrants; tanker truck agreements in place with Fire District 5; authority to take water from surface supplies.	Town-wide.	Effective.	None.

Development Review	Town-wide.	Effective.	None.
Public Education	Town-wide	Effective.	None.
GEOLOGIC HAZARDS			
The Massachusetts State Building Code	Town-wide.	Effective.	None.
Mobile generators and light pole for power/light backup	Town-wide	Effective.	None.

(This page left intentionally blank)

VII. MITIGATION MEASURES FROM THE 2005 PLAN

Review and Update Process

At a meeting of the Swampscott Hazard Mitigation Committee, Town staff reviewed the potential mitigation measures identified in the 2005 North Shore Regional Pre-Disaster Mitigation Plan Swampscott Annex and determined whether each measure had been implemented or deferred. Of those measures that had been deferred, the committee evaluated whether the measure should be deleted or carried forward into the 2015 Swampscott Hazard Mitigation Plan. The decision on whether to delete or retain a particular measure was based on the committee's assessment of the continued relevance or effectiveness of the measure and whether the deferral of action on the measure was due to the inability of the Town to take action on the measure.

Table 27.- Potential Mitigation Measures from the 2005 Plan

Mitigation Measure	Priority	Implementation Responsibility	Time Frame	2015 Status
Upgrade seawalls and outfalls at Preston Beach and Phillips' Beach	High	DPW	Years 1-2	Update complete at Phillips' Beach and 50% complete at Preston Beach.
Other water and sewer recommendations on stormwater not covered by the $275,000.	High	DPW	Years 1-2	Completed adding de-chlorination station and is 75% complete in evaluating CSO remediation options.
Repair Fisherman's Beach/Cassidy Park sea wall.	High	DPW	Years 1-3	Completed.
Repair/replace Harbormaster's boat	Medium	Town Meeting	Years 4-5	Completed.
Repair Blodgett Avenue sea wall	Medium	Sea wall is private.	Year 4	Completed privately.
Repair access road to Eiseman's Beach	Medium	DPW	Year 4	Completed.

Mitigation Measure	Priority	Implementation Responsibility	Time Frame	2015 Status
Develop fire roads in Harold King Forest	Low	Fire Dept.	Years 3-5	Not started or completed. The Town has chosen not to pursue this action for this update as coastal issues remain their top budget priority for now, though this may be renewed .
Equip fire department with smaller trucks suitable for brush fires.	Low	Fire Dept.	Years 3-5.	Not completed.

Swampscott has made considerable progress on implementing mitigation measures identified in the 2005 Hazard Mitigation Plan. Many of the measures identified in that plan are now considered on-going aspects of the regular work of Town staff from the department head level to the regular work of Public Works staff. Individual projects have been incorporated into the Town's capital improvement plan and the Town continues to seek FEMA grant funding to implement the home elevation program. Moving forward into the next five year plan implementation period there will be many more opportunities to incorporate hazard mitigation into the Town's decision making processes.

The challenges the Town faces in implementing these measures are primarily due to limited funding and available staff time.

VIII. HAZARD MITIGATION STRATEGY

What is Hazard Mitigation?

Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries and property resulting from natural and human-made hazards through long-term strategies.
These long-term strategies include planning, policy changes, programs, projects and other activities. FEMA currently has three mitigation grant programs: the Hazards Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation program (PDM), and the Flood Mitigation Assistance (FMA) program. The three links below provide additional information on these programs.

http://www.fema.gov/government/grant/hmgp/index.shtm
http://www.fema.gov/government/grant/pdm/index.shtm
http://www.fema.gov/government/grant/fma/index.shtm

Hazard Mitigation Measures can generally be sorted into the following groups:

- Prevention: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.
- Property Protection: Actions that involve the modification of existing buildings or infrastructure to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter resistant glass.
- Public Education & Awareness: Actions to inform and educate citizens, elected officials, and property owners about the potential risks from hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.
- Natural Resource Protection: Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- Structural Projects: Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms.
- Emergency Services Protection: Actions that will protect emergency services before, during, and immediately after an occurrence. Examples of these actions include protection of warning system capability, protection of critical facilities, and protection of emergency response infrastructure.
  (Source: *FEMA Local Multi-Hazard Mitigation Planning Guidance*)

Regional and Inter-Community Considerations

Some hazard mitigation issues are strictly local. The problem originates primarily within the municipality and can be solved at the municipal level. Other issues are inter- community issues that involve cooperation between two or more municipalities in a local area. There is a third level of mitigation which is regional; involving a state, regional, or federal agency or an issue that involves numerous municipalities across a wide area of the metropolitan region.

Regional Partners

In many communities, mitigating natural hazards, particularly flooding, is more than a local issue. The drainage systems that serve these communities are a complex system of storm drains, roadway drainage structures, pump stations and other facilities owned and operated by a wide array of agencies including but not limited to the Town of Swampscott, the Department of Conservation and Recreation (DCR), and Massachusetts Department of Transportation (MDOT). The planning, construction, operations, and maintenance of these structures are integral to the flood hazard mitigation efforts of communities. These agencies must be considered the communities regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do, including budgetary and staffing constraints and numerous competing priorities. In the sections that follow, the plan includes recommendations for activities where cooperation with these other agencies may be necessary. Implementation of these recommendations will require that all parties work together to develop solutions.

Inter-Community Considerations

The Town considers that coordination with other communities is excellent. If there is a regional emergency Lynn and Swampscott run their shelters as regional shelters so that residents can use the shelter closest to them, regardless of what community they reside in. Town emergency management personnel have expressed support for developing a regional radio dispatch facility in conjunction with Lynn and Nahant.

During storm events, storm surge travels up the storm drain outfall at King's Beach and prevents Stacy Brook, a large collection point for upland storm drainage, from draining to the ocean. Swampscott should continue to work with the City of Lynn and the Lynn Water and Sewer Commission, to study and implement a solution to prevent tidal surge from entering the drain during high surge events.

The Town of Swampscott and the City of Lynn will need to coordinate efforts on managing risks from Foster Pond Dam. The dam was created by Aggregate Industries, a quarrying company, to seal the Aggregate waste lagoon.

Sea Level Rise and Shoreline Environment – The coastal shoreline of the North Shore area is a dynamic environment where forces of sea-level rise, erosion and deposition are constantly at work changing the shoreline profile. This process disregards municipal boundaries as sand and other materials are moved along the coast. Shoreline protection measures such as sea walls, jetties, and others have an impact on this process with the potential of building up materials in some areas while

stripping it away from others.

Municipalities along the North Shore should work to understand how these processes and others associated with sea level rise and storm surge are at work locally and consider mutually beneficial means of protecting their shore side communities from the impacts of storm damage and sea-level rise. Swampscott should consider participating within a regional sea level rise action work group to help plan for and address sea level rise, storm surge and related climate adaptation issues on a regional basis.

Process for Setting Priorities for Mitigation Measures

The decision on priorities was made at a meeting of the local committee. The method used was to reach consensus through discussion, rather than taking a vote. Priority setting was based on local knowledge of the hazard areas, cost information and an assessment of benefits.

Prioritization of Mitigation Activities

The last step in developing the Town's mitigation strategy is to assign a level of priority to each mitigation measure so as to guide the focus of the Town's limited resources towards those actions with the greatest potential benefit. At this stage in the process, the Local Hazard Mitigation Committee has limited access to detailed analyses of the cost and benefits of any given measure, so prioritization is based on the committee member's knowledge of the existing and potential hazard impacts and an approximate sense of the costs associated with pursuing any given measure.

Prioritization occurred through discussion with the local committee and through subsequent review by committee members and public comment. Priority setting was based on local knowledge of the hazard areas, including impacts of hazard events and the extent of the area impacted and the relation of a given mitigation measure to the Town's identified goals. In addition, through the discussion, the local committee also took into consideration factors such as the number of homes and businesses affected, whether or not road closures occurred and what impact closures had on delivery of emergency services and the local economy, anticipated project costs, whether the Town currently had the technical and administrative capability to carry out the mitigation measures, whether any environmental constraints existed, and whether Swampscott would be able to justify the costs relative to the anticipated benefits.

The table below demonstrates the prioritization. For each mitigation measure, the geographic extent of the potential benefiting area is identified, an overall benefit in terms of High, Medium or Low is estimated, a cost in terms of High (greater than $50,000), Medium ($10,000 to $49,000), or Low (less than $10,000 or staff time) is identified, and based on these factors, each mitigation measure is categorized as High, Medium or Low. The level of benefit created by a project was based on an estimate of the number of homes, businesses, or people served by the mitigation action and an estimate of the costs or damages avoided via implementation of the mitigation measure. Where a more exact estimate of cost was know, this number was used instead. With this assessment, an approximate timeframe has been identified in which the municipality would attempt to achieve the mitigation measure.

Changes in Priorities from 2005 Plan

Mitigation measures from the 2005 Natural Hazard Mitigation Plan were included as being High, Medium or Low but without supporting methodology as to how the levels were determined for each project. Each action from the plan that has been rolled into this iteration have been marked with an asterisk (*) and a note made if the priority level has changed.

High Priority Mitigation Measures

Flooding, Drainage Infrastructure and Dams

- *Complete Preston Beach seawall and outfalls upgrade. Remains High Priority. The Swampscott DPW Director is the position responsible for this mitigation action.

- Install new pump station and extend drainage outfall a t the intersection of Shepard Avenue and Ocean Avenue to pump down Palmer Pond during times of high storm surge.

- Identify where utility lines, drainage outfalls and houses can be elevated above flooding areas along Puritan Road between Lincoln House Point and Smith Lane.

- Identify where utility lines and drainage outfalls can be elevated near the access road to the Fish House on Humphrey Street as storm surge backs up into storm drain outfalls in this area during storms and times of high coastal storm surge.

- Evaluate King's Beach storm surge flooding of beach outfall and identify solutions.

<u>Dams</u>

- Continue to maintain Foster Pond Dam as needed.
- Maintain and update CEMP.

Measures to Ensure Compliance with NFIP

- The Town should participate in the FEMA Community Rating System (CRS) program to lower flood hazard risk, raise community awareness and quality for lower flood hazard insurance premiums.

- Floodplain District Management: Continue to enforce the Floodplain Zoning District and associated building regulations for floodplain areas. Update this district to remain consistent with FEMA guidelines and floodplain mapping.

- Floodplain Mapping: Maintain up to date maps of local FEMA identified floodplains. The Town updated its Coastal Flood Plain bylaw and adopted the revised FEMA National Flood Insurance Rate maps in 2012.

- Acquisition of Vacant Flood Prone Lands: Acquire priority open space parcels in floodplain areas in order to maintain flood storage and water infiltration capacity.

- Complete the revision of the Town's existing Open Space and Recreation Plan and Identify Key Acquisition Parcels.

- Continue to enforce all wetlands ordinances and regulations.

Wind Related Hazards

- Purchase new front end loader with grappling attachment for emergency road clearance situations.
- Continue to implement the State Building Code, which contains clearly delineated requirements for new construction relative to structural resistance to wind –related hazards.
- Update and maintain plans for managing emergency response activities.
- Ensure that warning/notification and communication systems are in readiness.

- Assess vulnerability to severe winds such as hurricane events by taking actions such as:
  - Developing and maintaining a database to track community vulnerability to severe wind.
  - Using GIS to map areas that are at higher risk to wind hazard associated with different hurricane conditions (e.g. Category 1, 2, 3 etc.).
  - Using HAZUS to quantitatively estimate potential losses from hurricane wind.

- Work with the local electrical utility provider and Town Department of Public Works to ensure the following actions are taken:
  - Informing the utility of the Town's updated tree maintenance program and establish standards for all tree pruning around utility lines;
  - Incorporating the inspection and management of hazardous trees into the drainage system maintenance process.
  - Inspecting utility poles to ensure they meet specifications and are wind resistant.
  - Upgrading overhead utility lines- e.g. adjust utility pole size, utility pole span widths, and/or line strength.
  - Using designed-failure mode for power line design to allow lines to fall or fail in small sections rather than as a complete system to enable faster restoration.
  - Installing redundancies and loop feeds.

Multi Hazard and Communications

- Emergency Power Generators: Upgrade all emergency power generators in emergency shelters and critical facilities as needed; provide alternative fuel sources and generator power source flexibility. Install fixed generator in Town Hall.

- Purchase two electronic sign boards for evacuation and emergency management.

- Relocate three radio repeaters from the roof of the Greenwood School building for police, fire and DPW.

- Evaluate creating a regional radio dispatch center with Lynn and Nahant.

Brush Fires

- Increase brush fire capacity by purchasing new 2.5-ton, 4x4, brush fire truck with 250 gallon pumping capacity.* Now High Priority.
- Encourage all Town Departments to work closely with landowners and developers to identify and mitigate conditions that aggravate wildfires including;
    - Limited access for emergency equipment due to width and grade of roadways;
    - Inadequate water supplies and the spacing, consistency and species of vegetation around structures;
    - Highly flammable construction materials;
    - Inadequate entry and escape routes.

Winter Storms

- Swampscott should consider partnering with MEMA and FEMA to design and implement a winter storm preparedness program that reduces the risk to life, property and utility systems.

- Construct a new salt storage shed.

- Develop partnerships with utility providers and DPW to document known hazards.

- Acquire more traffic barriers to block access to flood or storm-created inaccessible sites.

  Identify appropriate shelters for people who may need to evacuate due to loss of electricity and heat and make their locations known to the public.
- Protect buildings and infrastructure by retrofitting public buildings to withstand snow loads and prevent roof collapse.

- Using snow fences or "living snow fences" e.g. rows of trees or shrubs, to limit blowing and drifting snow over critical roadway segments.

- Identifying specific at-risk populations that may be exceptionally vulnerable in the event of long-term power outages.

Medium Priority Mitigation Measures

Flooding, Drainage Infrastructure and Dams

- Consider updating site plan review and subdivision stormwater standards by referencing MA Stormwater Policy Standards.

- Complete the drafting and adoption of a stormwater management by law and regulations.

- Master Plan Update: Include a section on Climate Change Preparedness in the next update of the Town's master plan.

- Evaluate elevation of low sections of Stetson Avenue that floods during storm surge and high precipitation events.

- Evaluate solutions to flooding at Burrill Street railroad bridge underpass.

Wind Related

- Consider updating and implementing the tree maintenance program with additional funding. Distribute information to property owners to reduce risk of tree failure to life, property and utility systems; identify potentially hazardous trees in critical areas; increase tree program staffing as possible to identify and remove hazardous trees.

Winter Storms

- Consider participating in a regional Sea Level Rise Action Work Group with neighboring coastal communities to draft and implement preparedness actions for winter storms, storm surge and associated sea level rise coastal hazards.

Lower Priority Mitigation Measures

Geologic Related

- Public and Commercial Building Assessments: Develop an inventory and assess the earthquake vulnerability of all public and commercial buildings.

- Develop and implement a structural retrofitting program that prioritizes actions on the Town's older, un-reinforced masonry buildings.

- Landslides:
    - Complete an inventory of steep slope areas where critical facilities, other buildings and infrastructure, might be vulnerable to landslides, particularly in the event of an earthquake.
    - Develop and maintain a database to track community vulnerability to landslides.

- Encourage homeowners and renters to use "Is Your Home Protected from Earthquake Disaster? A Homeowner's Guide to Earthquake Retrofit" for economical and efficient mitigation techniques.

Flooding and Drainage Infrastructure

- Consider developing Town-base wetlands digital mapping capacity that would include an

all local wetlands delineations data base

- Create and implement a wetlands, flooding, and stormwater education and outreach program for Swampscott residents that incorporates new NFIP map and program information

Wildfires

- Develop and maintain a database to track the location of any wildfire hazard event.
- Include the consideration of wildfire risk and mitigation in any comprehensive, capital, emergency response or open space planning efforts.
- Perform arson prevention cleanup activities in areas of abandoned or collapsed structures, accumulated trash or debris, and any area where spills or dumping may have occurred.
- Routinely inspect the functionality of fire hydrants.

Drought

- Promote drought tolerant landscape design through measures such as:

  - Incorporate drought tolerant native species into development landscape regulations.
  - Using permeable driveways and surfaces to promote groundwater infiltration and reduce stormwater runoff.

Extreme Temperatures

- Green Buildings and Parking areas to reduce urban heat island impacts: plant trees to shade buildings, parking areas and public ways; encourage the use of green roofs or cool roofing products to reflect sun and heat away from a building.

Further Analysis of Mitigation Projects

Based on information gained from the Benefit-Cost Analysis and a review of the STAPLEE criteria (a checklist for evaluating social, technical, administrative, political, legal, economic and environmental issues) MAPC asked the local committee to take into consideration factors such as the number of homes and businesses affected, whether or not road closures occurred and what impact closures had on delivery of emergency services and the local economy, anticipated project costs, whether the town had the technical and administrative capability to carry out the mitigation measures, whether any environmental constraints existed, and whether the town would be able to justify the costs relative to the anticipated benefits.

An analysis of the proposed mitigation projects, using STAPLEE criteria, has been completed and is summarized in Table 28.

For Table 28, the following symbols apply to indicate degree of Hazard Mitigation Alternative Acceptability:

- = Acceptable
- = Somewhat Acceptable

TABLE 28. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES

PROJECTS ALTERNATIVE	Socially Acceptable	Technically Feasible	Administratively Possible	Politically Acceptable	Legal	Economically Sound	Environmentally Sound	Cost Range
Flooding – High Priority Alternatives								
Preston Beach Seawall and outfalls upgrade	•	•	•	•	•	•	•	High
Install new Palmer Pond drainage upgrades	•	•	•	•	•	•	•	High
Identify where houses and utilities can be elevated on Puritan Rd.	•	•	•	•	•	•	•	Moderate

TABLE 28. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	**Socially Acceptable**	**Technically Feasible**	**Administratively Possible**	**Politically Acceptable**	**Legal**	**Economically Sound**	**Environmentally Sound**	**Cost Range**
Identify utility elevation opportunities on Humphrey Street near Fish House	•	•	•	•	•	•	•	Moderate
Evaluate solutions to King's Beach storm surge outfall flooding	•	•	•	•	•	•	•	High
Maintain Foster Pond Dam	•	•	•	•	•	•	•	Moderate
Participate in the FEMA Community Rating System	•	•	•	•	•	•	•	Low
Continue to enforce the Floodplain Zoning District	•	•	•	•	•	•	•	Low
Maintain Floodplain Mapping	•	•	•	•	•	•	•	Low
Acquire Vacant Flood Prone Lands	•	•	•	•	•	•	•	High
Complete revision of Open Space and Recreation Plan and Identify Key Acquisition Parcels	•	•	•	•	•	•	•	Moderate

TABLE 28. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	**Socially Acceptable**	**Technically Feasible**	**Administratively Possible**	**Politically Acceptable**	**Legal**	**Economically Sound**	**Environmentally Sound**	**Cost Range**
Continue to enforce all wetlands ordinances and regulations	•	•	•	•	•	•	•	Low
Wind Related- High Priority Alternatives								
Purchase Front-end loader with grappling attachment	•	•	•	•	•	•	•	Moderate
Continue to implement the State Building Code	•	•	•	•	•	•	•	Moderate
Update and maintain plans for managing emergency response activities	•	•	•	•	•	•	•	Low
Ensure that warning/notification and communication systems are in readiness	•	•	•	•	•	•	•	Low
Hurricanes: Assess vulnerability to severe winds	•	•	•	•	•	•	•	Moderate
Work with electrical utility and DPW on best practices	•	•	•	•	•	•	•	Low

TABLE 28. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	**Socially Acceptable**	**Technically Feasible**	**Administratively Possible**	**Politically Acceptable**	**Legal**	**Economically Sound**	**Environmentally Sound**	**Cost Range**
Hurricanes: Assess vulnerability to severe winds	•	•	•	•	•	•	•	Moderate
Multi-hazard- High Priority Alternatives								
Upgrade all emergency power generators in emergency shelters and critical facilities	•	•	•	•	•	•	•	Moderate
Install new diesel, fixed location generator at Town Hall	•	•	•	•	•	•	•	Moderate
Purchase and install two electronic evacuation sign boards	•	•	•	•	•	•	•	Moderate
Purchase and install three radio repeaters	•	•	•	•	•	•	•	Moderate
Evaluate regional dispatch center	•	•	•	•	•	•	•	Moderate
Fire- High Priority Alternatives								
Increase brush fire capacity by	•	•	•	•	•	•	•	Moderate
purchasing new 2.5-ton, 4x4, brush fire truck								

TABLE 28. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	**Socially Acceptable**	**Technically Feasible**	**Administratively Possible**	**Politically Acceptable**	**Legal**	**Economically Sound**	**Environmentally Sound**	**Cost Range**
Encourage all Town Departments to work closely with landowners and developers to identify and mitigate conditions that aggravate wildfires	•	•	•	•	•	•	•	Low
Winter Storm-High Priority Alternatives								
Consider partnering with MEMA and FEMA to design and implement a winter storm preparedness program	•	•	•	•	•	•	•	Low
Construct a new road salt storage shed	•	•	•	•	•	•	•	Moderate
Develop partnerships with utility providers and DPW to document known hazards	•	•	•	•	•	•	•	Low
Acquire emergency traffic barriers	•	•	•	•	•	•	•	Moderate
Identify appropriate shelters for people who may need to evacuate	•	•	•	•	•	•	•	Low

TABLE 28. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	**Socially Acceptable**	**Technically Feasible**	**Administratively Possible**	**Politically Acceptable**	**Legal**	**Economically Sound**	**Environmentally Sound**	**Cost Range**
Retrofit at-risk critical, public building roofs to withstand snow	•	•	•	•	•	•	•	High
Construct snow fences	•	•	•	•	•	•	•	High
ID populations vulnerable to long term power outage	•	•	•	•	•	•	•	Low
Flooding- Medium Priority Alternatives								
Update site plan review and subdivision control standards	•	•	•	•	•	•	•	Low
Complete drafting and adoption of stormwater management by law and regulations	•	•	•	•	•	•	•	Low
Consider Master Plan Update with Climate Adaptation	•	•	•	•	•	•	•	Moderate

TABLE 28. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	**Socially Acceptable**	**Technically Feasible**	**Administratively Possible**	**Politically Acceptable**	**Legal**	**Economically Sound**	**Environmentally Sound**	**Cost Range**
Evaluate elevation of Stetson Ave. Will require significant land taking	•	•	•	•	•	•	•	High
Evaluate Burrill Street railroad bridge drainage solutions	•	•	•	•	•	•	•	Moderate
Wind Related- Medium Priority Alternatives								
Update tree maintenance program	•	•	•	•	•	•	•	Moderate
Winter Storm-Medium Priority Alternatives								
Consider participating in a regional Sea Level Rise/Coastal Hazard Action Workgroup	•	•	•	•	•	•	•	Low
Flooding- Lower Priority Alternatives								
Create digital local wetlands mapping and delineations data base	•	•	•	•	•	•	•	Moderate
Upgrade current wetlands, flooding and stormwater education outreach program	•	•	•	•	•	•	•	Low
Geologic-Lower Priority Alternatives								

TABLE 28. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	**Socially Acceptable**	**Technically Feasible**	**Administratively Possible**	**Politically Acceptable**	**Legal**	**Economically Sound**	**Environmentally Sound**	**Cost Range**
Encourage use of earthquake retrofit guide by homeowners and renters	•	•	•	•	•	•	•	Low
Develop an inventory and assess earthquake vulnerability of public and commercial buildings	•	•	•	•	•	•	•	Low
Develop and implement a structural retrofitting program for earthquake vulnerable buildings	•	•	•	•	•	•	•	High
Landslides: inventory steep slopes and develop database	•	•	•	•	•	•	•	Low
Fire- Lower Priority Alternatives								

TABLE 28. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	**Socially Acceptable**	**Technically Feasible**	**Administratively Possible**	**Politically Acceptable**	**Legal**	**Economically Sound**	**Environmentally Sound**	**Cost Range**
Develop wildfire data base	•	•	•	•	•	•	•	Low
Include wildfire risk in planning	•	•	•	•	•	•	•	Low
Arson cleanup and prevention	•	•	•	•	•	•	•	Low
Routine inspection of fire hydrants	•	•	•	•	•	•	•	Low
Drought- Lower Priority Alternatives								
Promote drought tolerant land design measures	•	•	•	•	•	•	•	Low

TABLE 28. EVALUATION OF PRIORITY HAZARDS MITIGATION ALTERNATIVES								
PROJECTS ALTERNATIVE	**Socially Acceptable**	**Technically Feasible**	**Administratively Possible**	**Politically Acceptable**	**Legal**	**Economically Sound**	**Environmentally Sound**	**Cost Range**
Implement Green Building and Parking BMPs	•	•	•	•	•	•	•	Moderate
Extreme Temps- Lower Priority Alternatives								
Create database to track at risk populations for	•	•	•	•	•	•	•	Low

Introduction to Mitigation Measures Table

Priority – The designation of high, medium, or low priority was done at the meeting of the Local Multiple Hazard Community Planning Team meeting. The designations reflect discussion and a general consensus developed at the meeting but could change as conditions in the community change. In determining project priorities, the local team considered potential benefits and project costs.

Hazard Area – Each mitigation measure is intended to address one or more of the natural hazard potentially impacting Swampscott, such as Flooding, Wind, Fire, and Earthquake. Where the proposed measure is intended to address a specific locally identified area of concern, this area is identified as well.

Description of the Mitigation Measure – The description of each mitigation measure is brief and cost information is given only if cost data were already available from the community. The cost data represent a point in time and would need to be adjusted for inflation and for any changes or refinements in the design of a particular mitigation measure.

Measure Type – There are six different types of pre-disaster mitigation measures identified by FEMA for which a community may apply for Hazard Mitigation funding.

Implementation Responsibility – The designation of implementation responsibility was done by MAPC based on a general knowledge of what each municipal department is responsible for. It is likely that most mitigation measures will require that several departments work together and assigning staff is the sole responsibility of the governing body of each community.

Time Frame – The time frame was based on a combination of the priority for that measure, the complexity of the measure and whether or not the measure is conceptual, in design, or already designed and awaiting funding. Because the time frame for this plan is five years, the timing for all mitigation measures has been kept within this framework.
The identification of a likely time frame is not meant to constrain a community from taking advantage of funding opportunities as they arise.

Potential Funding Sources – This column attempts to identify the most likely sources of funding for a specific measure. The information on potential funding sources in this table is preliminary and varies depending on a number of factors. These factors include whether or not a mitigation measure has been studied, evaluated or designed, or if it is still in the conceptual stages. MEMA and DCR assisted MAPC in reviewing the potential eligibility for hazard mitigation funding. Each grant program and agency has specific eligibility requirements that would need to be taken into consideration. In most instances, the measure will require a number of different funding sources. Identification of a potential funding source in this table does not guarantee that a project will be eligible for, or selected for funding. Upon adoption of this plan, the local committee responsible for its implementation should begin to explore the funding sources in more detail.

Additional information on funding sources – The best way to determine eligibility for a particular funding source is to review the project with a staff person at the funding agency. The following websites provide an overview of programs and funding sources.

Army Corps of Engineers (ACOE) – The website for the North Atlantic district office is http://www.nae.usace.army.mil/. The ACOE provides assistance in a number of types of projects including shoreline/stream bank protection, flood damage reduction, flood plain management services and planning services.

Massachusetts Emergency Management Agency (MEMA) – The grants page http://www.mass.gov/dem/programs/mitigate/grants.htm has a useful table that compares eligible projects for the Hazard Mitigation Grant Program and the Flood Mitigation Assistance Program.

United States Department of Agriculture – The USDA has programs by which communities can get grants for firefighting needs. See the link below for some example.

http://www.rurdev.usda.gov/rd/newsroom/2002/cfg.html

Abbreviations Used in Table 29

FEMA Mitigation Grants includes:
- FMA = Flood Mitigation Assistance Program.
- HMGP = Hazard Mitigation Grant Program.
- PDM = Pre-Disaster Mitigation Program

ACOE = Army Corps of Engineers.

MHD = Massachusetts Highway Department.

EOT = Executive Office of Transportation.

DCR = Department of Conservation and Recreation

DHS/EOPS = Department of Homeland Security/Emergency Operations

EPA/DEP (SRF) = Environmental Protection Agency/Department of Environmental Protection (State Revolving Fund)

USDA = United States Department of Agriculture

Table 29. Potential Mitigation Measures

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
High Priority Mitigation Measures						
Flooding	Preston Beach Seawall and outfalls upgrade	Structural Projects	DPW	2015-2016	$750,000	Bonding/PDM
Flooding	Palmer Pond drainage upgrades	Structural Projects	DPW	2015-2016	$1.15 million	Bonding/PDM
Flooding	ID where houses and utilities can be elevated along Puritan Rd. Rd.	Structural Projects	DPW	2015-2016	$$50,000	General fund
Flooding	Identify Humphrey Street utility elevation priorities near Fish House	Structural Projects	DPW	2015-2016	$50,000	General fund
Flooding	Evaluate solutions to King's Beach storm surge outfall flooding	Structural Project	DPW	2015-2020	$150,000	General fund
Dams	Maintain Foster Pond Dam	Structural Project	DPW	2015-2020	$2,500 per year staff and equipment	DPW budget
Flooding	Participate in CRS Program	Public Information and Mapping; Flood Damage Reduction, Flood Preparedness	CRS Committee, Conservation Commission, EM Director	2015-2020	Town staff costs incorporated into Town budget, not to exceed $20,000 per year to implement	General fund

Table 29. Potential Mitigation Measures

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Flooding	Continue to enforce the Floodplain Zoning District and associated building regulations for floodplain areas; update district as needed to consistent with FEMA guidelines	Public Information and Mapping; Flood Damage Reduction, Flood Preparedness	Building Dept.	2015-2020	$25,000 per year	
Flooding	Floodplain mapping updates; Swampscott expects to receive new maps in 2012	Natural Resource Protection	Planning/ Conservation Commission	2015-2020	$5,000 per year	General fund
Flooding	Acquire/preserve flood prone lands.	Natural Resource Protection	Planning/ Conservation Commission	2015-2020	Determined by land cost when parcel(s) identified.	PDM/Bonding/Private Land Trust not yet identified
Flooding	Complete Open Space and Recreation Plan revision	Natural Resource Protection	Planning/ Conservation Commission	2015-2020	$15,000 staff time	General fund
Flooding	Continue to enforce all wetlands ordinances and regulations	Natural Resource Protection	Planning/ Conservation Commission	2015-2020	$20,000 per year in staff time	General fund
Wind Related	Purchase Front-end loader with grappling attachment	Emergency Services Protection	DPW	2015-2020	$100,000	General fund
Wind Related	Continue to implement the State Building Code	Prevention	Building Department	2015-2020	$50,000 per year staff time	General fund

Table 29. Potential Mitigation Measures

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Wind Related	Update and maintain plans for managing emergency response activities	Emergency Services Protection	Fire	2015-2020	$2500 per year staff time	General fund
Wind Related	Ensure that warning/notification and communication systems are in readiness	Emergency Services Protection	Fire and Police	2015-2020	$1500 per year staff time	General fund
Wind Related	Develop and maintain a database to track vulnerability to high winds	Emergency Services Protection	EMD	2015-2020	$2,000 per year staff time	General fund
Wind Related	Use GIS to map high risk wind areas for hurricanes	Emergency Services Protection	EMD	2015-2020	$2500	General fund
Wind Related	Use HAZUS to estimate potential losses from wind	Emergency Services Protection	EMD	2015-2020	$1,000	General fund
Multi-hazard	Upgrade fixed, emergency power generators	Emergency Services Protection	Fire/DPW	2015-2017	$75,000	General fund
Multi-hazard	Install new, fixed generator at Town Hall	Emergency Services Protection	DPW	2015-2017	$80,000	General fund
Multi-hazard	Purchase two electronic sign boards	Emergency Services Protection	Fire/Police	2015-2017	$35,000	General fund

Table 29. Potential Mitigation Measures

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Multi-hazard	Evaluate regional dispatch center	Emergency Services Protection	Fire/Police/DP W	2015-2017	$50,000	General fund
Brush Fires	Purchase new 4x4 fire truck, pump and forestry hose	Emergency Services Protection	Fire	2015-2017	$125,000	General fund
Brush Fires	Encourage all Town Departments to work closely with landowners and developers to identify and mitigate conditions that aggravate wildfires	Public Information	Planning and Fire Department	2015-2020	$2,000 per year staff time	General fund/Fire budget
Winter Storms	Winter Storm Preparedness program with MEMA and FEMA	Prevention	DPW/FEMA/ MEMA	2015-2016	$5,000/year staff time	MPTA
Winter Storms	Construct new salt storage shed	Structural Project	DPW	2015-2016	$100,000	General fund
Winter Storms	Partner with utility to document known hazards	Prevention	DPW/Utilities	2015-2016	$2,500/year	General fund/Utility
Winter Storms	Traffic barriers	Emergency Services Protection	DPW	2015-2018	$1,500 each	General fund

Table 29. Potential Mitigation Measures

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Winter Storms	Identify appropriate shelters for people who may need to evacuate	Emergency Services Protection	Fire	2015-2020	$2,500/year staff time	General fund
Winter Storms	Retrofit at-risk critical, public building roofs to withstand snow loads	Emergency Services Protection	DPW	2018-2020	$250,000	PDM
Winter Storms	Construct snow fences	Structural Project	DPW	2018-2020	$150,000	PDM
Winter Storms	ID populations vulnerable to long term power outage	Prevention	Planning	2018-2020	$2,000 staff time	General fund, MPTA
Medium Priority Mitigation Measures						
Flooding	Master Plan/Drainage Plan Climate Update	Prevention	Planning	2015-2020	$25,000	General fund
Flooding	Update subdivision and site plan review standards	Prevention	Planning	2015-2019	$5,000 staff time	General fund
Flooding	Stormwater management plan and regulations	Prevention	DPW	2015-2019	$10,000 staff time	General fund
Flooding	Elevate low areas of Stetson Avenue	Structural	DPW	2015-2019	$500,000	Bond
Flooding	Evaluate solutions for Burrill Street underpass flooding	Structural	DPW	2015-2019	$25,000	General fund

Table 29. Potential Mitigation Measures

Hazard Area	Mitigation Measures	Measure Type	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Wind Related	Update tree maintenance program	Emergency Services	DPW	2015-2017	$15,000/year staff time	General fund
Winter Storms	Regional Sea Level Rise Action Work Group participation	Prevention	Planning/DPW/ Conservation Commission	2015-2029	$5,000 per year staff time	Swampscott
Lower Priority Mitigation Measures						
Geologic	Assess earthquake vulnerability	Prevention	Planning	2015-2019	$20,000	General fund
Geologic	Assess any slopes	Prevention	Planning	2015-2020	$10,000	General fund
Wildfires	Develop and maintain wildfire tracking database	Natural Resource Protection	Fire	2015-2020	$10,000	Fire budget
Wildfires	Perform arson prevention activities	Natural Resource Protection	Fire	2015-2020	$5,000	Fire budget
Wildfires	Inspect hydrants on a routine basis	Emergency Service Protection	Fire	2015-2020	$2,000 per year	Fire budget
Drought	Incorporate drought tolerant species into landscape regs.	Prevention	Planning/Conservation Commission	2015-2020	$5,000	General fund
Extreme Temperatures	Use Green buildings and parking best practices to reduce heat and runoff	Natural Resource Protection	Planning/Conservation Commission/DPW	2015-2020	$10,000	General fund

IX. PLAN ADOPTION AND MAINTENANCE

Plan Adoption

The Swampscott Hazard Mitigation Plan 2015 Update was adopted by the Board of Selectmen on [ADD DATE]. See Appendix D for documentation. The plan was approved by FEMA on [ADD DATE] for a five-year period that will expire on [ADD DATE].

Plan Maintenance

MAPC worked with the Swampscott Hazard Mitigation Planning Team to prepare this plan. This group will continue to meet on an as-needed basis to function as the Local Hazard Mitigation Implementation Group, with one Town official designated as the coordinator. Additional members could be added to the local implementation group from businesses, non-profits, and institutions. . The public will be invited to all meetings in accordance with the Massachusetts Open Meeting Law.

Implementation Schedule

Bi-Annual Survey on Progress– The coordinator of the Hazard Mitigation Implementation Team, who is designated as the Emergency Management Director, will prepare and distribute a biannual survey in years two and four of the plan. The survey will be distributed to all of the local implementation group members and other interested local stakeholders. The survey will poll the members on any changes or revisions to the plan that may be needed, progress and accomplishments for implementation, and any new hazards or problem areas that have been identified.
MAPC will send an annual reminder to each Local Hazard Mitigation Team contact person to check their hazard mitigation planning schedule and to conduct their bi-annual survey if in year two or four of their plan.

This information will be used to prepare a report or addendum to the local hazard mitigation plan. The Hazard Mitigation Implementation Team will have primary responsibility for tracking progress and updating the plan.

Develop a Year Four Update – During the fourth year after initial plan adoption, the coordinator of the Hazard Mitigation Implementation Team will convene the team to begin to prepare for an update of the plan, which will be required by the end of year five in order to maintain approved plan status with FEMA. The team will use the information from the year four biannual review to identify the needs and priorities for the plan update. MAPC will send an annual reminder to each Local Hazard Mitigation Team contact person to check their hazard mitigation planning schedule and to conduct their four year update if in year four of their plan

Prepare and Adopt an Updated Local Hazard Mitigation Plan – FEMA's approval of this plan is valid for five years, by which time an updated plan must be approved by FEMA in order to maintain the Town's approved plan status and its eligibility for FEMA mitigation grants. Because of the time required to secure a planning grant, prepare an updated plan, and complete the approval and adoption

of an updated plan, the local Hazard Mitigation Planning Team should begin the process by the end of Year 3. This will help the Town avoid a lapse in its approved plan status and grant eligibility when the current plan expires.

At this point, the Hazard Mitigation Implementation Team may decide to undertake the update themselves, contract with the Metropolitan Area Planning Council to update the plan or to hire another consultant. However, if the Hazard Mitigation Implementation Team decides to update the plan, the group will need to review the current FEMA hazard mitigation plan guidelines for any changes. The update of the Swampscott Hazard Mitigation Plan will be forwarded to MEMA and DCR for review and to FEMA for approval.

Integration of the Plans with Other Planning Initiatives

Upon approval of the Swampscott Hazard Mitigation Plan 2015 Update by FEMA, the Local Hazard Mitigation Implementation Team will provide all interested parties and implementing departments with a copy of the plan and will initiate a discussion regarding how the plan can be integrated into that department's ongoing work. At a minimum, the plan will be reviewed and discussed with the following departments:

- Fire / Emergency Management
- Police
- Public Works
- Planning
- Conservation
- Recreation
- Health
- Building

Other groups that will be coordinated with include large institutions, Chambers of Commerce, land conservation organizations and watershed groups. The plan will also be posted on a community's website with the caveat that local team coordinator will review the plan for sensitive information that would be inappropriate for public posting. The posting of the plan on a web site will include a mechanism for citizen feedback such as an e-mail address to send comments.

X. LIST OF REFERENCES

In addition to the specific reports listed below, much of the technical information for this plan came from meetings with Town department heads and staff.

FEMA Local Multi-Hazard Mitigation Planning Guidance, July 1, 2008 Town of

Swampscott General Bylaws

Town of Swampscott Zoning Bylaw

Town of Swampscott, Subdivision Control Regulations

Town of Swampscott, Comprehensive Emergency Management Plan Commonwealth of

Massachusetts, MacConnell Land Use Statistics, 2005 Metropolitan Area Planning Council,

Geographic Information Systems Lab Metropolitan Area Planning Council, Regional Plans

and Data

(This page left intentionally blank)

APPENDIX A
MEETING AGENDAS

Don Boyce
DIRECTOR

dcr

Richard Sullivan
COMMISSIONER

MAPC

Marc D. Draisen
EXECUTIVE DIRECTOR

NORTH SHORE HAZARD MITIGATION PLANNING TEAM

Beverly
Lynn
Nahant
Peabody
Revere
Salem
Saugus
Swampscott
Winthrop

THE COMMONWEALTH OF MASSACHUSETTS

Deval Patrick, Governor

MASSACHUSETTS EMERGENCY MANAGEMENT AGENCY
400 WORCESTER ROAD, FRAMINGHAM, MA 01702-5399 508-820-2000 FAX 508-820-1404

DEPARTMENT OF CONSERVATION AND RECREATION
251 CAUSEWAY STREET, SUITE 600-900, BOSTON, MA 02114-2104 617-626-1250 FAX 617-626-1351

METROPOLITAN AREA PLANNING COUNCIL
60 TEMPLE PLACE, 6TH FLOOR, BOSTON, MA 02111 617-451-2770 FAX 617-482-7185

North Shore Hazard Mitigation Planning Team

First Meeting

Monday, February 8, 10:00 AM

Saugus Public Safety Building
2nd Floor Training Room
27 Hamilton Street, Saugus, MA
(Map & directions attached)

AGENDA

10:00 WELCOME & INTRODUCTIONS

10:05 OVERVIEW OF HAZARD MITIGATION PLANNING & GRANTS

- State Hazard Mitigation Plan & FEMA Grants–Sarah White, MEMA
- Regional & Local Mitigation Plans - Martin Pillsbury, MAPC

10:20 UPDATING THE NORTH SHORE HAZARD MITIGATION PLAN

- FEMA Requirements & Grant Eligibility
- Review of Scope of Work & Schedule –MAPC
- Questions & Discussion – Local issues & Priorities

10:50 GETTING STARTED: MAPPING AND CRITICAL FACILITIES DATABASE FOR THE NORTH SHORE PLAN UPDATE

- Susan Brunton, GIS Analyst, MAPC

11:15 NEXT STEPS / ADJOURN

If you have any questions please contact Martin Pillsbury at MAPC:
617-451-2770, ext. 2012 or mpillsbury@mapc.org

Swampscott Predisaster Mitigation Renewal Planning Meeting March 28, 2011
Swampscott Town Hall 10 AM– 12 PM

Agenda

1. Welcome and Introductions

2. Project Overview (*Sam Cleaves, MAPC*)

3. Survey Handout and Ortho Map Markup of Hazardous Areas/ Conversation:

   What has changed from 2005 PDM Plan?

   Review past Areas of Concern and Potential Areas of Development, Priority Projects

   Plan Update:

   - What floods? How often? Any new mitigation studies done? What mitigation measures have been done or planned for? High or low priority?

   - Other hazards: Brush fires, dams, earthquake, high winds? What areas? Dam studies available?

   - Map known future development areas? Type, size, status of permitting

4. Review Draft Project Goals: See over

5. Discuss Project Outreach: See over

6. Review mitigation projects: community actions and new priority projects/costs

7. Next Steps: Follow up with individuals as needed, continue information gathering, set priority mitigation projects and costs, maximize community collaboration on projects

---

Project Overview - MAPC received a grant to prepare natural hazards *Pre-Disaster Mitigation Plan* for the communities of Beverly, Lynn, Nahant, Swampscott, Swampscott, Salem, Saugus, Swampscott and Swampscott. MAPC is working with the nine communities to update their plans to mitigate potential damages of natural hazards such as floods, winter storms, hurricanes, earthquakes and wild fires, before such hazards occur. The federal *Disaster Mitigation Act of 2000* requires that all municipalities adopt a *Pre-Disaster Mitigation Plan* for natural hazards in order to remain eligible for FEMA Disaster Mitigation Grants.

Public Participation Options

1. Presentation by Town/Town staff to local groups.
2. MAPC presents at a public meeting – existing board or commission*
3. Post on Town/Town website with a set public review period.
4. Distribute to specified organizations or boards/commissions for their review.
5. Create a summary document and distribute in community

Draft Sample Goals

1. Prevent and reduce the loss of life, injury, public health impacts and property damages resulting from all major natural hazards.

2. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.

3. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.

4. Prevent and reduce the damage to public infrastructure resulting from all hazards.

5. Encourage the business community, major institutions and non-profits to work with the Town/Town to develop, review and implement the hazard mitigation plan.

6. Work with surrounding communities, state, regional and federal agencies to ensure regional cooperation and solutions for hazards affecting multiple communities.

7. Ensure that future development meets federal, state and local standards for preventing and reducing the impacts of natural hazards.

8. Take maximum advantage of resources from FEMA and MEMA to educate Town staff and the public about hazard mitigation.

APPENDIX B

HAZARD MAPPING

The MAPC GIS (Geographic Information Systems) Lab produced a series of maps for each community. Some of the data came from the Northeast States Emergency Consortium (NESEC). More information on NESEC can be found at http://www.serve.com/NESEC/. Due to the various sources for the data and varying levels of accuracy, the identification of an area as being in one of the hazard categories must be considered as a general classification that should always be supplemented with more local knowledge. The documentation for some of the hazard maps was incomplete as well.

The map series consists of eight maps as described below.

Map 1.	Population Density
Map 2.	Potential Development
Map 3.	Flood Zones
Map 4.	Earthquakes and Landslides
Map 5.	Hurricanes and Tornados
Map 6.	Average Snowfall
Map 7.	Composite Natural Hazards
Map 8.	Hazard Areas

Reduced-scale copies of the map series are included in this Appendix for general reference. Full sized PDF's of the Swampscott maps can be downloaded from the MAPC File Transfer Protocol (FTP) website: ftp://ftp.mapc.org/Hazard_Mitigation_Plans/maps/Swampscott/

Map1: Population Density – This map uses the US Census block data for 2000 and shows population density as the number of people per acre in seven categories with 60 or more people per acre representing the highest density areas.

***Map 2: Potential Development* –** This map shows potential future developments, and critical infrastructure sites. MAPC consulted with Town staff to determine areas that were likely to be developed or redeveloped in the future.

Map 3: Flood Zones – The map of flood zones used the FEMA NFIP Flood Zones as its source. For more information, refer to the FEMA Map Service Center website http://www.msc.fema.gov. The definitions of the flood zones are described in detail on this site as well. The flood zone map for each community also shows critical infrastructure and municipally owned and protected open space.

***Map 4: Earthquakes and Landslides* –** This information came from NESEC. For most communities, there was no data for earthquakes because only the epicenters of an earthquake are mapped.

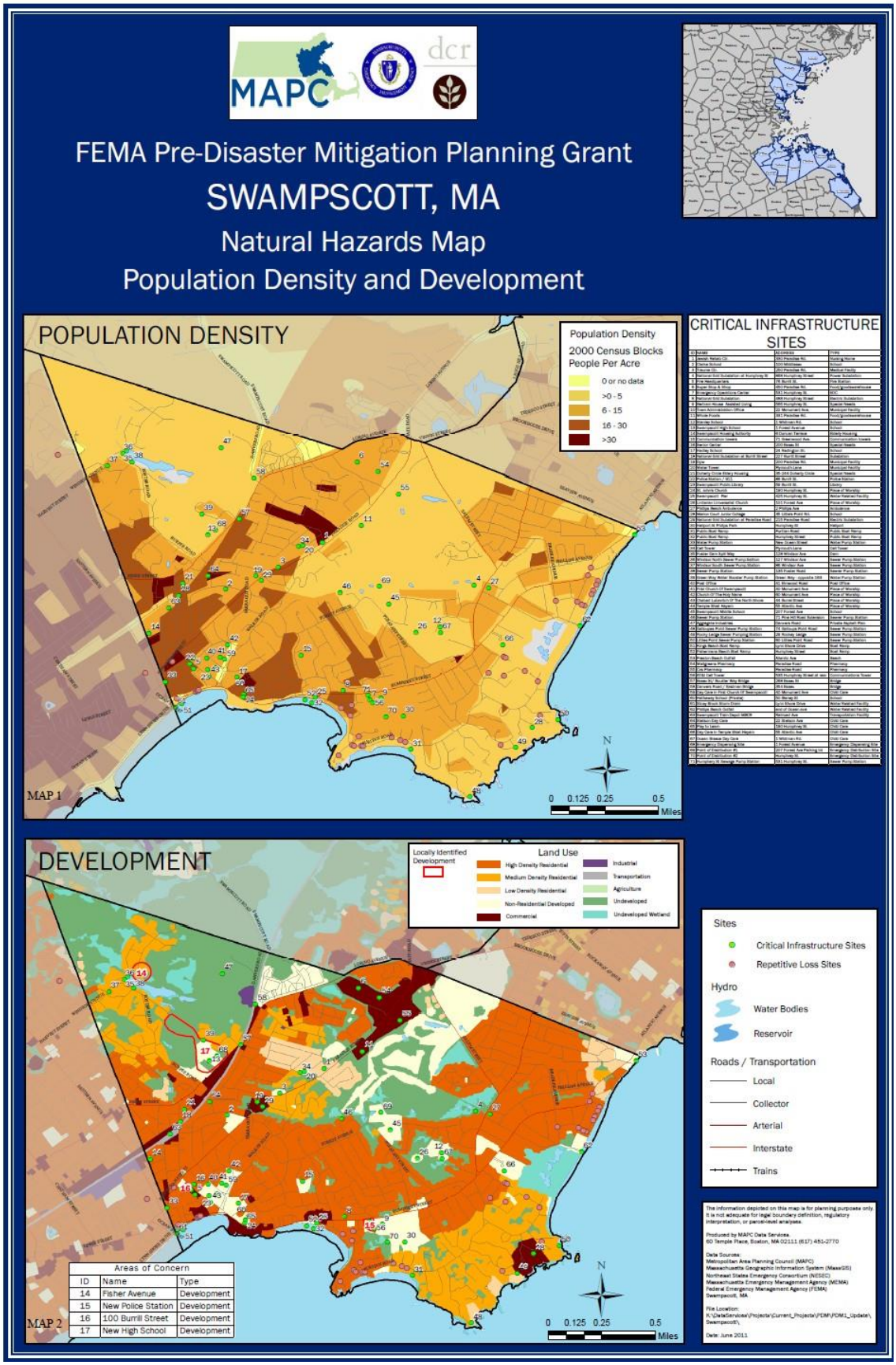
The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to http://pubs.usgs.gov/pp/p1183/pp1183.html.

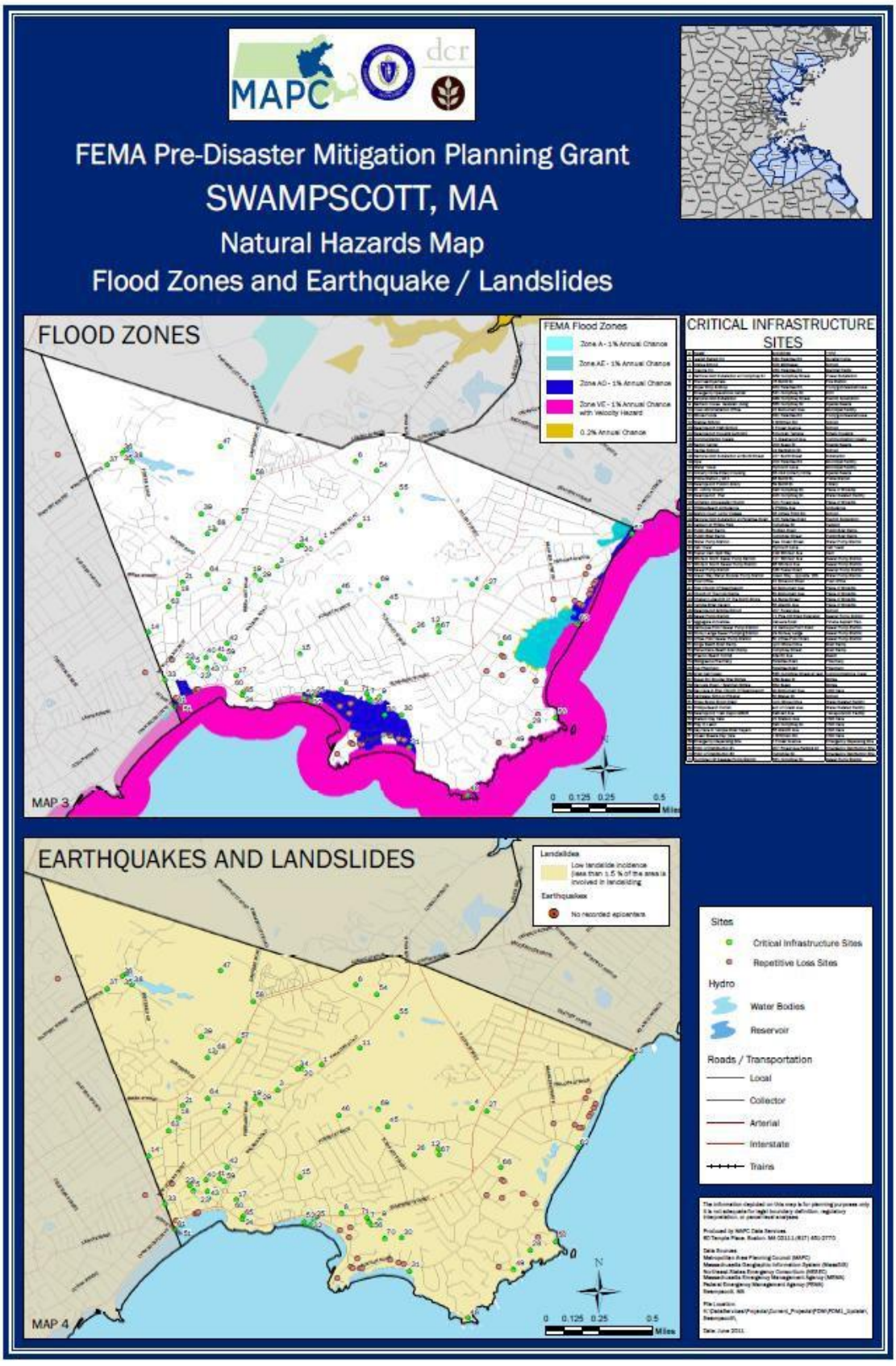
Map 5: Hurricanes and Tornados – This map shows a number of different items. The map includes the storm tracks for both hurricanes and tropical storms. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In most cases, the effects of the wind and rain from these storms were felt in other communities even if the track was not within that community. This map also shows the location of tornados with a classification as to the level of damages. What appears on the map varies by community since not all communities experience the same wind- related events. These maps also show the 100 year wind speed.

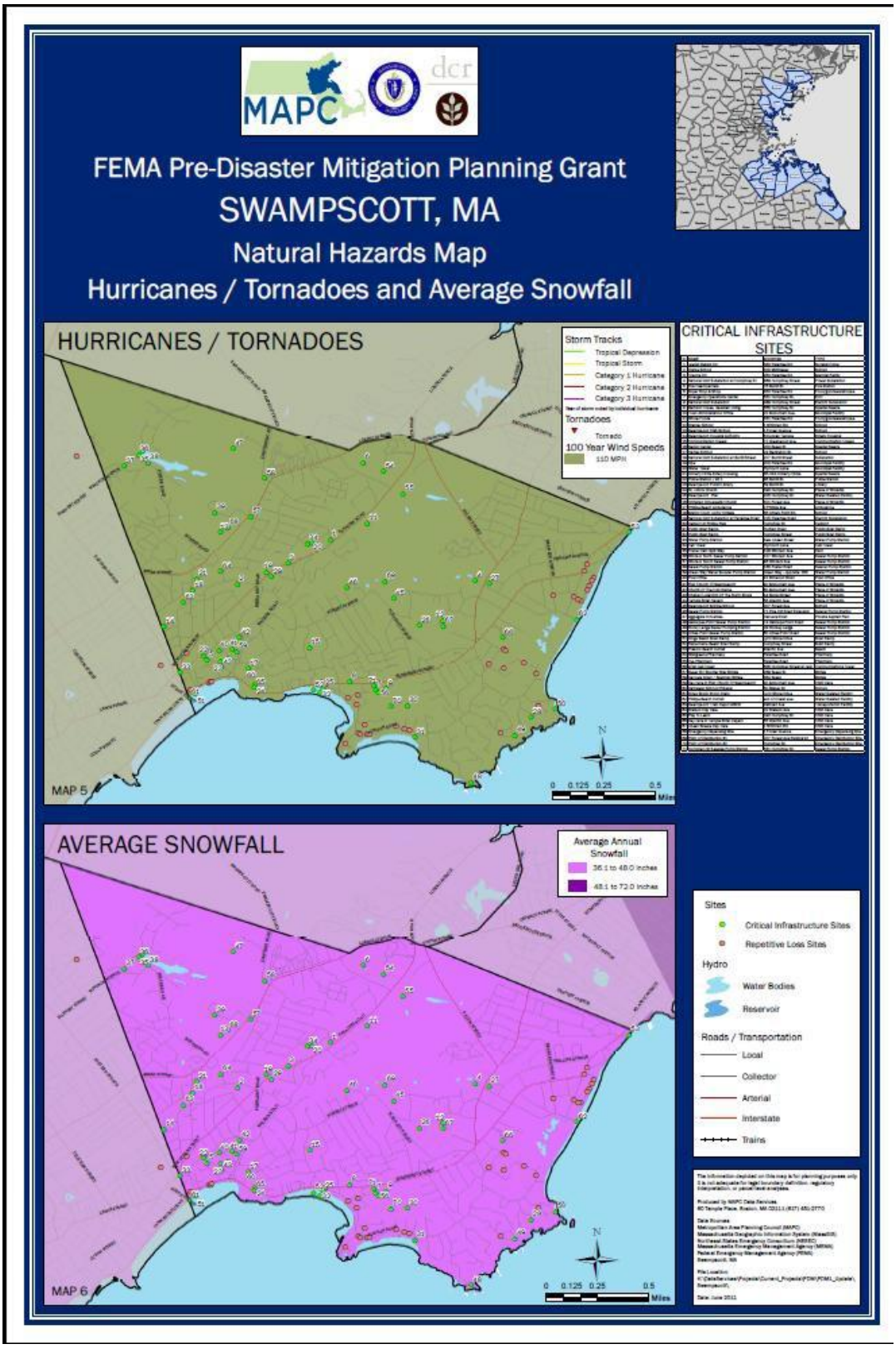
Map 6: Average Snowfall - - This map shows the average snowfall and open space. It also shows storm tracks for nor'easters, if any storms tracked through the community.

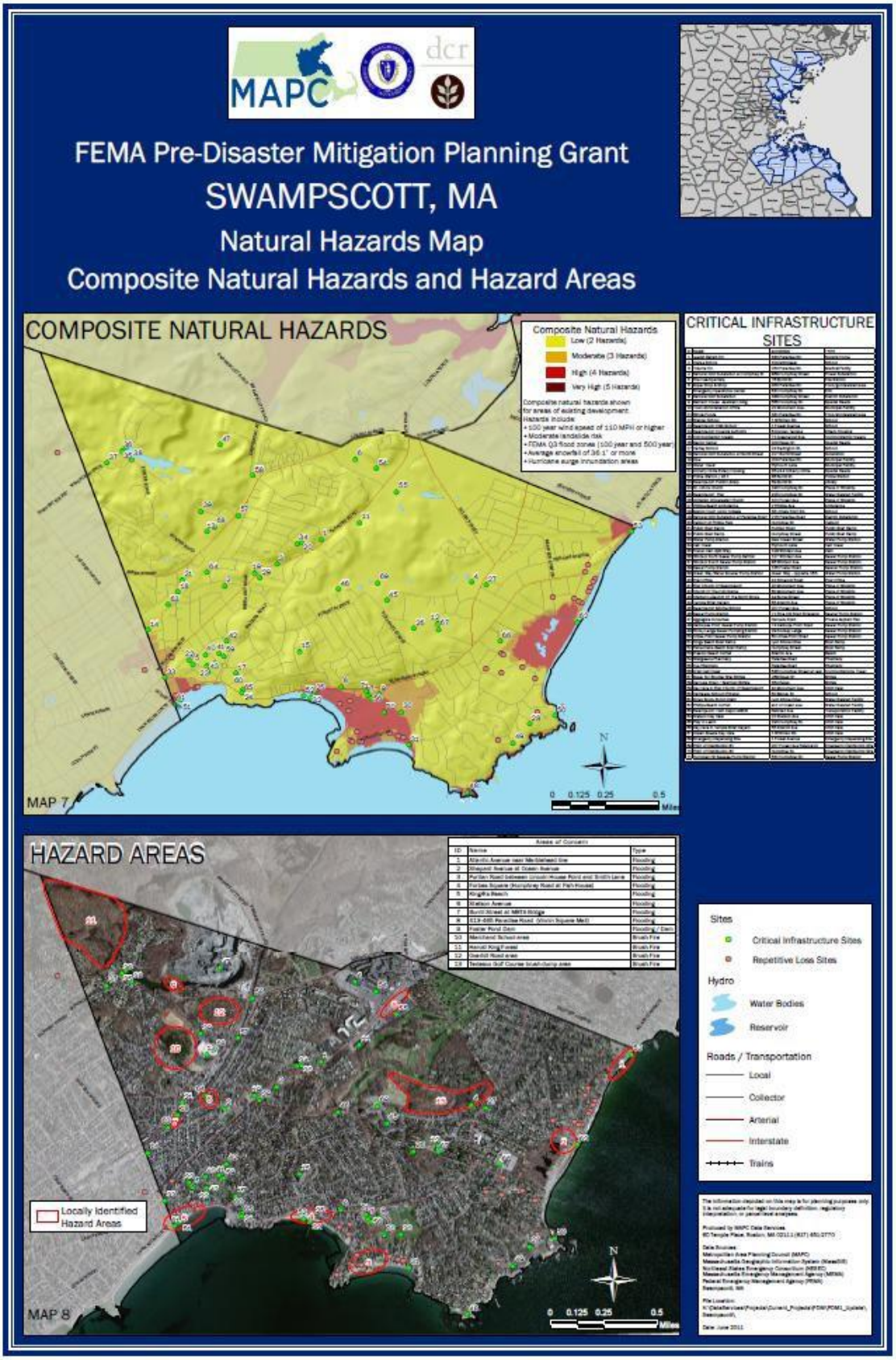
Map 7: Composite Natural Hazards - This map shows four categories of composite natural hazards for areas of existing development. The hazards included in this map are 100 year wind speeds of 110 mph or higher, low and moderate landslide risk, FEMA Q3 flood zones (100 year and 500 year) and hurricane surge inundation areas. Areas with only one hazard were considered to be low hazard areas. Moderate areas have two of the hazards present. High hazard areas have three hazards present and severe hazard areas have four hazards present.

Map 8: Hazard Areas – For each community, locally identified hazard areas are overlaid on an aerial photograph dated April, 2008. The critical infrastructure sites are also shown. The source of the aerial photograph is Mass GIS.


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
SWAMPSCOTT, MA
Natural Hazards Map
Population Density and Development
POPULATION DENSITY
Population Density
2000 Census Blocks
People Per Acre
0 or no data
>0 - 5
6 - 15
16 - 30
>30
MAP 1
0 0.125 0.25 0.5
Miles
CRITICAL INFRASTRUCTURE SITES
DEVELOPMENT
Locally Identified Development
Land Use
High Density Residential
Medium Density Residential
Low Density Residential
Non-Residential Developed
Commercial
Industrial
Transportation
Agriculture
Undeveloped
Undeveloped Wetland
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
Areas of Concern
ID | Name | Type
14 | Fisher Avenue | Development
15 | New Police Station | Development
16 | 100 Burrill Street | Development
17 | New High School | Development
MAP 2
0 0.125 0.25 0.5
Miles
The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis.
Produced by MAPC Data Services.
60 Temple Place, Boston, MA 02111 (617) 451-2770
Data Sources:
Metropolitan Area Planning Council (MAPC)
Massachusetts Geographic Information System (MassGIS)
Northeast States Emergency Consortium (NESEC)
Massachusetts Emergency Management Agency (MEMA)
Federal Emergency Management Agency (FEMA)
Swampscott, MA
File Location:
K:\DataServices\Projects\Current_Projects\FDM\FDM1_Update\Swampscott\
Date: June 2011


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
SWAMPSCOTT, MA
Natural Hazards Map
Flood Zones and Earthquake / Landslides
FLOOD ZONES
FEMA Flood Zones
Zone A - 1% Annual Chance
Zone AE - 1% Annual Chance
Zone AO - 1% Annual Chance
Zone VE - 1% Annual Chance with Velocity Hazard
0.2% Annual Chance
CRITICAL INFRASTRUCTURE SITES
MAP 3
0 0.125 0.25 0.5 Miles
EARTHQUAKES AND LANDSLIDES
Landslides
Low landslide incidence (less than 1.5 % of the area is involved in landsliding
Earthquakes
No recorded epicenters
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
MAP 4
0 0.125 0.25 0.5 Miles


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
SWAMPSCOTT, MA
Natural Hazards Map
Hurricanes / Tornadoes and Average Snowfall
HURRICANES / TORNADOES
Storm Tracks
Tropical Depression
Tropical Storm
Category 1 Hurricane
Category 2 Hurricane
Category 3 Hurricane
Tornadoes
Tornado
100 Year Wind Speeds
110 MPH
CRITICAL INFRASTRUCTURE SITES
MAP 5
N
0 0.125 0.25 0.5
Miles
AVERAGE SNOWFALL
Average Annual Snowfall
36.1 to 48.0 Inches
48.1 to 72.0 Inches
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
MAP 6
N
0 0.125 0.25 0.5
Miles


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
SWAMPSCOTT, MA
Natural Hazards Map
Composite Natural Hazards and Hazard Areas
COMPOSITE NATURAL HAZARDS
Composite Natural Hazards
Low (2 Hazards)
Moderate (3 Hazards)
High (4 Hazards)
Very High (5 Hazards)
Composite natural hazards shown for areas of existing development.
Hazards include:
• 100 year wind speed of 110 MPH or higher
• Moderate landslide risk
• FEMA Q3 flood zones (100 year and 500 year)
• Average snowfall of 36.1" or more
• Hurricane surge innundation areas
CRITICAL INFRASTRUCTURE SITES
MAP 7
0 0.125 0.25 0.5 Miles
HAZARD AREAS
Locally Identified Hazard Areas
MAP 8
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains

APPENDIX C
DOCUMENTATION OF PUBLIC PARTICIPATION

Town of Swampscott
OFFICE OF THE
Planning Board

Elihu Thomson Administrative Building Swampscott,
Massachusetts 01907

Notice is hereby given that the Swampscott Planning Board will be holding a public meeting on Monday, February 6, 2012, beginning at 7:00 pm, at the Swampscott Senior Center, 200 Rear Essex St. Mandatory to close and complete meeting no later than 10 pm.

AGENDA:

Sam Cleaves, of the Metropolitan Area Planning Council, will present Swampscott's FEMA Natural Hazard Mitigation Plan to the Planning Board. This meeting, as well as MAPC's presentation to the Board of Selectmen, will detail the planning process behind the Plan and provide an outline of it. The draft plan will soon be ready for public posting and comment.

Board of Selectman Barry Greenfield will discuss some initial zoning options around the MBTA commuter rail station.

Master Plan Update - Pete Kane, Town Planner, will provide initial results to the community- wide survey that was sent out to all residents (and available online) on January 18th. The survey officially closed February 3rd – results and analysis of the surveys will be completed by February 17th. Mr. Kane will also present options to the Board to discuss the potential path they may take for the master plan.

Planning Board Authority Update – Angela Ippolito, Board member, will confirm slot reservation on the warrant for an article to amend 5.4.3.0 of the Zoning Bylaws. Board will review current language and decide on amendment to be presented.

Other business that may properly come before the Board.

SELECTMEN'S MEETING AGENDA

Wednesday, March 14, 2012

7:00P.M.**Swampscott Town Hall, 22 Monument Avenue, Swampscott, Mass 01907**
EXECUTIVE SESSION:

- Strategy Session for Contract Negotiations with Non-Union Personnel – Town Administrator Position

7:30P.M.
OPEN SESSION / DISCUSSION:

- Renewable Energy Committee/ Wind Feasibility Study.

7:45P.M. DISCUSSION"

- **Sam Cleaves / FEMA / Disaster Litigation Plan.**

8:00P.M. DISCUSSION:

- *Historical Commission/ Historic District Study Committee/ Naming of the first floor conference room at Town Hall.*

8:30P.M.
DISCUSSION:

- *Charlotte Rd parking and the need for Resident Permit Parking signs there to Wednesdays agenda.*

8:45P.M
VOTES OF THE BOARD:

1. Open and Close Town Meeting Warrant.
2. Approval of invoice for Kopelman & Paige, P.C. in the amount of $17,952.00, for services through January 31, 2012.
3. Approval of a Common Victuallers permit for Chipotle Mexican Restaurant, 450 Paradise Road, Swampscott, Mass pending approval from the Health Department.
4. Approval of a request from Jack Gould to display a temporary sign at the new chain link back stop facing Humphrey Street from April through May to seek new members for the 2012 softball season.
5. Approval of meeting minutes from February 27, 2012.0
6. Approval of an entertainment license for the Swampscott Public Library for the Harbor Festival which will take place on Saturday, June 23, 2012 at Fisherman's Beach which will include ten live band.
7. Approval to hold a Special Town Meeting on May 7, 2012 at 8:30P.M.

9:00P.M:
RESIDENT COMMENT

(This page left intentionally blank)

APPENDIX D

DOCUMENTATION OF PLAN ADOPTION

[To be added to final plan after adoption by the Town]

<TOWN LETTERHEAD>

CERTIFICATE OF ADOPTION
BOARD OF SELECTMEN
TOWN OF SWAMPSCOTT, MASSACHUSETTS

A RESOLUTION ADOPTING THE TOWN OF SWAMPSCOTT
HAZARD MITIGATION PLAN 2015 UPDATE

WHEREAS, the Town of Swampscott established a Committee to prepare the *Town of Swampscott Hazard Mitigation Plan 2015 Update,* and

WHEREAS, the *Town of Swampscott Hazard Mitigation Plan 2015 Update* contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Swampscott, and

WHEREAS, duly-noticed public meetings were held by the PLANNING BOARD on February 6, 2012 and by the BOARD OF SELECTMEN on March 14, 2012, and

WHEREAS, the Town of Swampscott authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the plan, and

NOW, THEREFORE BE IT RESOLVED that the Town of Swampscott BOARD OF SELECTMEN adopts the *Town of Swampscott Hazard Mitigation Plan 2015 Update*, in accordance with M.G.L. 40 §4 or the charter and bylaws of the Town of Swampscott.

ADOPTED AND SIGNED this Date. _____

Name(s)

Title(s)

Signature(s)

ATTEST